A RAND NOTE

Observations of the Caravan Guard 89 Exercise

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Leland Pleger, Thomas Polsley

RAND

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Prepared for the
United States Army

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PREFACE

This Note presents interim results of RAND Arroyo Center research on training strategies for the Army, focusing on future REFORGER (Return of Forces to Germany) exercises. The emphasis is on the lessons learned from the Caravan Guard 89 (CG 89) exercise, and on the issues they raised for the Centurion Shield 90 exercise (part of REFORGER 90). The intended primary audience is the exercise designers in the U.S. Army, Europe (USAREUR), although other exercise designers will find the Note of interest.

RAND's primary focus during CG 89 was on the simulations and the interfaces between the live soldier-in-the-field portions and the computer-simulated portions of the exercise. An early draft of this document had a significant effect on the design and planning of the REFORGER 90 exercise and has been examined by the planners of the REFORGER 92 exercise.[1] A companion document (N-3152-A, forthcoming) presents RAND observations on the Centurion Shield 90 (CS 90) exercise. Findings from the CG 89, CS 90, and other exercises are extended and interpreted in a comprehensive report on future large-scale multiechelon exercises (R-4156-A, forthcoming), as part of RAND's project on "Unit Training Strategies."

This research was conducted in the Arroyo Center's Manpower and Training program and was carried out through the Arroyo Center's USAREUR office in Heidelberg, Germany. Mr. Thomas Polsley, one of the authors of this Note, is an employee of the U.S. Army Training and Doctrine Command (TRADOC); he was assigned to the Arroyo Center's USAREUR office in 1989-1990.

The Arroyo Center

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[1]See Patrick Allen et al., *Observations of the Centurion Shield 90 Exercise*, RAND, N-3152-A, 1992.

Army Regulation 5-21 contains basic policy for the conduct of the Arroyo Center. The Army provides continuing guidance and oversight through the Arroyo Center Policy Committee (ACPC), which is co-chaired by the Vice Chief of Staff and by the Assistant Secretary for Research, Development, and Acquisition. Arroyo Center work is performed under contract MDA903-91-C-0006.

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Lynn E. Davis is Vice President for the Army Research Division and Director of the Arroyo Center. Those interested in further information about the Arroyo Center should contact her office directly:

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SUMMARY

BACKGROUND AND OBJECTIVE

Large-scale field exercises, such as those conducted by U.S. and NATO forces in Germany, are both economically and politically costly. One of the more obvious negative aspects of such exercises is maneuver damage--the damage to civilian crops and property caused by units maneuvering over private and public civilian property during training. Especially during periods of reduced tensions, military planners seek methods of reducing these effects while maintaining force readiness.

The employment of more simulations and less actual combat equipment is one way to reduce the maneuver damage and operating costs of an exercise. Simulations also tend to train personnel in certain functional areas (e.g., the deep battle cell of the intelligence staff) better than more traditional training methods (e.g., field exercises).

In 1989, the U.S. Army decided to perform a test to determine the feasibility of employing combat simulations in support of a large-scale field exercise. The first experimental exercise was the U.S. V Corps Caravan Guard 89 (CG 89) exercise, held from September 13 through 20, 1989. The results of this experiment would greatly influence the design and scope of another large exercise less than four months later: Centurion Shield 90 (CS 90), which was part of a larger regular exercise called Return of Forces to Germany (REFORGER). The purpose of this Note is to document our observations of the CG 89 experience and the issues and recommendations that emerged from it.[1]

EXERCISE MODES

The modes of training examined in this test included: a field training exercise (FTX); a command field exercise (CFX); and two types of computer-assisted command post exercises. The simulations employed were the Corps Battle Simulation (CBS) at the V Corps simulation center, and the Ground Warfare Simulation (GRWSIM) and

[1]Conclusions on the broader issue of the future simulation support of large-scale field exercises were presented in the final report of this project, Patrick Allen, *Simulation Support of Large-Scale Exercises: A REFORGER Case Study*, RAND, R-4156-A, forthcoming.

Air War Simulation System (AWSIM) models at the Warrior Preparation Center (WPC).[2]

In the FTX mode, all or most of the equipment and personnel in a unit are placed in the field and often oppose other units that are also deployed in FTX mode. This is the most expensive mode of training because of the expenditure of consumables (fuel, food, and spare parts) and because of maneuver damage. At the same time, the FTX mode has tended to be the most realistic mode of training because it places the largest number of personnel and equipment under field conditions, with all of the obstacles and pitfalls of maneuvering in the field.

In the CFX mode, only a portion of the personnel and equipment is placed in the field. Fewer personnel and equipment in the field mean reduced costs in both consumables and maneuver damage. Sometimes, a CFX uses substitute equipment (such as wheeled instead of tracked vehicles) to further reduce the cost of consumables and maneuver damage. However, the CFX mode of training tends to contain more artificialities than does an FTX. For example, two CFX command vehicles, each representing an opposing company, may pass each other in the field without contact, while actual companies in the field would detect and engage each other.

Traditional field training exercises use only one training mode--either FTX or CFX. During CG 89, some armored maneuver battalions participated in FTX mode, others in CFX mode, and still others in computer-assisted exercise (CAX) mode. All light infantry units were trained in the FTX mode. Umpires in the field had to assess not only the results of FTX units versus FTX units or CFX units against CFX units, but also FTX units versus CFX units.

In a CAX mode, simulated units tend to have either no equipment and personnel in the field or only the equipment and personnel of a brigade or battalion headquarters. The costs of exercises that employ simulation are quite small in terms of consumables and maneuver damage, although the simulations entail their own costs for such items as computer hardware, software, communications, and personnel to operate the simulation equipment.

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[2]At the time of the Caravan Guard 89 exercise, the CBS model was called by its former name: the Joint Exercise Support System (JESS). The name of JESS was changed to Corps Battle Simulation as of October 1, 1989. Since all of the other documents in this series refer to the CBS model, this document will refer to CBS as well.

Two types of CAX training modes were combined during CG 89. Located on the flanks of the live maneuver box, the simulations created flank situations for the training audience to address. They also provided simulated units to flesh out a full corps to train the corps headquarters elements. A live scout platoon was used to provide the interface between the simulated units in CBS and the live units in the field. No scout platoons or other live units were used to provide an interface between units simulated at the WPC and units in the field.

Each training mode brings with it inherent artificialities. Exercises are not real combat and as such will lack some of the realism of combat. One of the purposes of exercise design is to reduce the artificialities of the training mode so that the training objectives may be achieved.

Additional artificialities occur, however, when multiple training modes are used in a single exercise. For example, it is difficult to assess combat results between an FTX unit with all of its equipment and personnel against a CFX unit with a fraction of the equipment and personnel. It is even more difficult to assess combat results between units in the FTX mode and units in the simulation mode. How does the "live" side fight a simulated opponent who presents no signature in the field?

RAND's focus during this exercise was on the simulation interfaces, including simulations interfacing with each other and with the CFX/FTX. Therefore, this document focuses only on the technical and functional area issues, rather than on political and cost issues.

DESCRIPTION OF THE CG 89 BATTLEFIELD

The U.S. V Corps Caravan Guard Exercise took place from September 13 through 20, 1989. A parallel Air Force live-fly exercise called Cold Fire provided a number of aircraft in support of CG 89, as well as support from an Allied Tactical Operations Center (ATOC).

On the ground, each side (Blue Northland and Red Southland) had one live division with subordinate units operating in either FTX or CFX mode (see Figure S.1). Southland's live Blue division was considered Gold in color, since that is the traditional designation of the opposing side when Blue units fight Blue units. Both Blue and Gold units use U.S. or NATO equipment and doctrine.

The west flank was simulated at brigade level using CBS, with scout platoons to provide the interface with the live portion of the exercise. The east flank of the live play box, the west flank of the CBS simulation box, and the deep and rear battles for

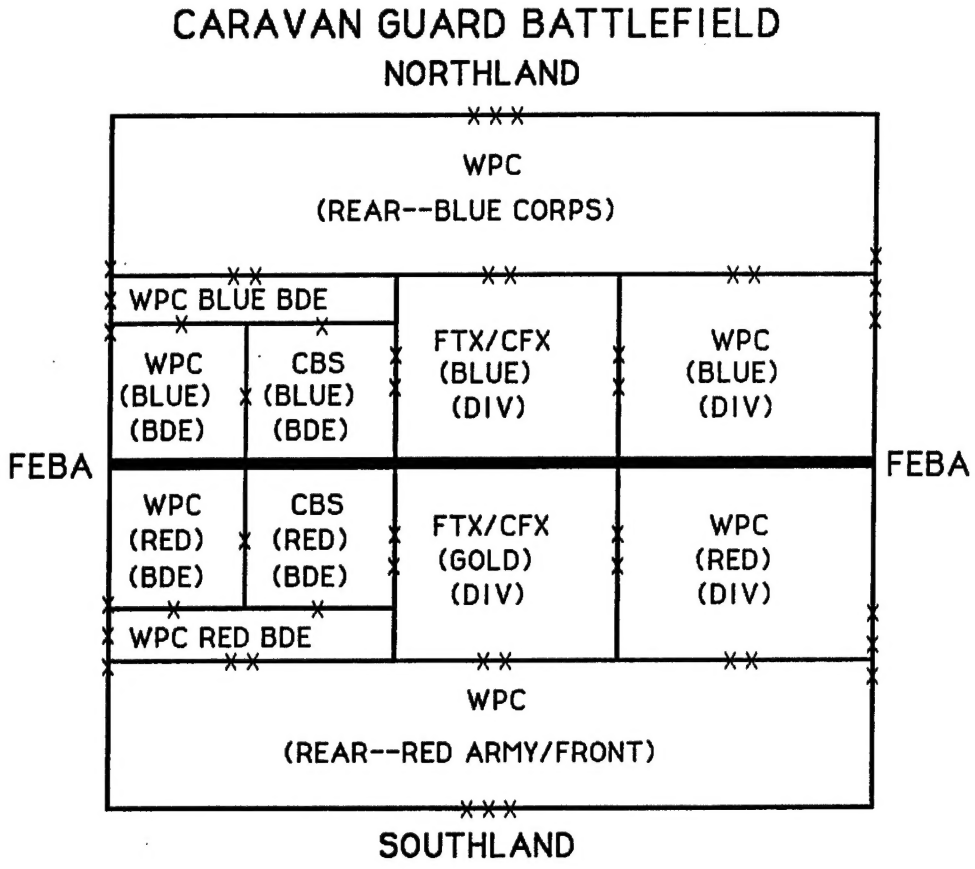

Figure S.1—Caravan Guard 89 Exercise Battlefield

both live and simulated units were simulated at the WPC. Scout platoons were not provided on the WPC/live interface.

The corps staff elements selected for training were primarily the intelligence staff and the deep battle or deep operations cell. This deep battle cell was set up to support Northland's operations. The WPC GRWSIM model provided an opposing Red threat from Southland to train the Northland deep battle cell. Note that in the simulations, Southland employed Red equipment, doctrine, and tactics, while in the FTX/CFX box, Southland employed Blue equipment, doctrine, and tactics.

One objective of a multimode exercise is to present as "seamless" a battlefield as possible to the training audience and assessment processes. All of the functional area activities in one training mode should be able to interact with the functional areas of the other training modes with no unnecessary artificiality. If the battlefield

does not appear to be seamless to the training audience, the achievement of the training objectives may suffer. For example, if one training objective is to synchronize the close, deep, rear, and flank operations, then the actions in one functional area must interact properly with the actions of the other functional areas. However, if the actions performed in one training mode cannot translate into the other training mode, then units in each training mode are invulnerable to each other, and act as if on separate battlefields.

RECOMMENDATIONS

This document contains a number of specific issues and recommendations organized by functional area. The information is presented in a format that is easy to reference: an issue is presented along with more detailed discussion, followed by a recommendation.

Among the 37 issues and recommendations presented in this Note, the following recommendations appear particularly important because they cover many functional areas, or are fundamental to any exercise of this type. These key recommendations are grouped into those involving simulations, those involving functional area representation, and those involving exercise preparation.

Key Recommendations Involving Simulations

1) Start simulations two or three days before the start of the exercise (STARTEX) to work out problems before the FTX/CFX begins.
2) Ensure that backup communications are available for the simulations.
3) Have a single person in charge of all of the simulations during the exercise.

Key Recommendations Involving the Functional Areas

1) Coordinate early the representation of air defense (AD) and joint suppression of enemy air defenses (JSEAD) operations. We recommend duplicate representation of all air defense assets in both the WPC and CBS models so that aircraft flown in either simulation face a similar threat. Similarly, when a JSEAD operation is being performed, both models should reduce the effectiveness of the enemy air defense via a

control move. Otherwise, unbalanced and disjointed air wars will occur in the two simulations.

2) Coordinate the movement rates of the threat represented in the simulations with the doctrinal norms anticipated by the deep battle cell. For example, threat unit movement rates have doctrinal norms, but the norms in the simulations do not necessarily correspond to those expected by the deep battle cell. Movement rates of threat units observed by the deep battle cells need to be coordinated before the start of the exercise. Otherwise, the deep battle training audience will be training to norms that are not comparable to doctrine.

3) Modify the intelligence collection model to provide raw data rather than fused data to the field exercise units for CS 90. It is anticipated in CS 90 that most of the intelligence fusion staff will be included in the training audience.

Key Recommendations Involving Exercise Preparation

1) Determine the training audience by name and the specific tasks in which they will be trained. (Defining a Mission Essential Task List, or METL, will help.) Specify training support personnel and any collateral training expected during the exercise. Specify who is in charge of monitoring the information flow into and out of the training cells to ensure that training objectives are met, and to act as a point of contact for counteracting training mode artificialities.

2) Prepare for liaison officers and scout platoons on each flank of the FTX/CFX box adjacent to the simulated flanks (see Figure S.1). During CG 89, a scout platoon was employed only between the live and CBS box. A scout platoon would assist in the interface between the flank of the live box and the WPC box. Also investigate the option of using the CBS model on both flanks of the live box, with the WPC models surrounding the CBS and FTX/CFX boxes.

3) Increase Air Force participation, especially in air and ground coordination personnel.

CONCLUSIONS

The 1989 Caravan Guard exercise was intended to be an experiment, designed to test a "proof of concept." The concept was to determine the technical feasibility of combining combat simulations with a field training exercise to improve the quality of training while simultaneously reducing training costs.

From our observations, the experiment appears to have been a successful demonstration of the technical feasibility of including simulations in field exercises. At the same time, there were many lessons, both positive and negative, learned from the experiment that will be useful for future large-scale field exercises employing simulations. See Table S.1 for a list of the issues as presented in this document.

A single exercise provides a relatively narrow database, and any conclusions drawn must be viewed as preliminary. Analysis of the evidence does suggest some general conclusions. First, although difficult to quantify, it appears that simulations benefit the training of some functional areas. Some staff sections, such as the deep battle cells, derived more benefit from simulation-supported exercises than they did from a traditional FTX.

Second, a definitive judgment on cost comparison alone is not possible. Although expenses associated with maneuver damage and consumables decline, simulations bring added costs for communication and support personnel. But absolute dollar cost may not be the most important concern. The political benefit of reduced maneuver damage might outweigh the increased cost for using simulations. That benefit alone might make the simulation-supported exercise the mode of choice for the future.

Table S.1
Issues Addressed in This Note

	Communications and Hardware Links
1.	Simulation downtime can be reduced in future exercises.
2.	Communications link downtime and interrupts were severe.
3.	Improve the information exchange among training modes.
4.	Single authority is needed to coordinate simulations.
	Issues by Functional Area
5.	Updates across the interfaces need to be more consistent.
6.	The unified live and simulated C2 structure was not well understood early in the exercise, leading to confusion and limiting the training benefit.
7.	The play of air space management was limited in this exercise.
8.*	There was no coordination of air play between WPC and CBS.
9.	Limited participation by Air Force personnel created difficulties in air and ground coordination training.
10.	The number and effectiveness of CAS sorties flown in support of the corps battle may not have been realistic.
11.	Simulated aircraft are not as restricted by weather as actual aircraft flying in support of the exercise.
12.*	Air defense assets must be included in the exercise in order to balance the effects of fixed- and rotary-wing aircraft.
13.	No JSEAD was played in the simulations.
14.	Electronic warfare (EW) was not played in the exercise.
15.	The deep battle cells need to be opposed by a Red force deep and on the flanks.
16.*	The initial deployment of Red forces did not match Red doctrine.
17.	The intelligence collection model (ICM) provides too much information for this application.
18.*	Sensors are reporting data in ICM that were not tasked by the collection center.
19.	Intelligence collection and reporting should be balanced for both sides in the exercise.
20.*	Intelligence data tended to come in large bundles rather than spread out over time.
21.	Intelligence collected in the simulations can seriously contradict data collected in the live box by live assets.
22.*	There was confusion on the availability of Battle Damage Assessment (BDA) data.
23.	Although the corps picture was not "seamless," it provided a significant increase in training opportunities.
24.	There did not appear to be any deception played in either simulation.
25.	The deep battle cell was sufficiently stressed, but the rear area movement of enemy forces was sometimes unrealistic.
26.	When units are entered into the simulations during the game, additional artificialities are introduced.
27.	The deep fire assets available to the deep battle staff need to be defined before the start of the exercise.

* Denotes issue specific to the CG 89 or the CS 90 exercise. All other issues apply to large-scale multiechelon multimode training exercises.

Table S.1 (Continued)

28.*	There is a potential disconnect between the two deep battles played by Blue and the two rear battles played by Blue in REFORGER 90.
29.	The counterbattery representation needs to be improved across all training modes (FTX/CFX, CBS, and WPC).
30.	Artillery should be severely constrained by artillery-ammunition constraints, but this does not occur in the FTX/CFX.
31.	The attrition rates between the CBS and WPC simulations may differ significantly.
32.	Assessing combat between FTX/CFX units and simulated units did not work well.
33.	Straight leg infantry is not well represented in the simulations.
34.	The representation of barriers, barrier construction, and barrier breaching needs work in each training mode.
35.	Combat Service Support (CSS) constraints need to be able to restrict the activities of combat and combat support units in the exercise.
36.	The use of Red air assault into Blue's rear area did not follow doctrine.
37.	The representation of special operations forces (SOF), long-range reconnaissance patrols (LRRPs), and Spetsnaz forces was very limited in the exercise.

* Denotes issue specific to the CG 89 or the CS 90 exercise. All other issues apply to large-scale multiechelon multimode training exercises.

ACKNOWLEDGMENTS

The authors are grateful for all of the cooperation provided by the personnel involved in the Caravan Guard exercise. Although we cannot name all of those who provided information and assistance, we give special thanks to the following: Colonel Darrel Charlton, Chief of the Exercise Division, Headquarters, U.S. Army, Europe (USAREUR); Colonel Douglas Campbell, Commander, Warrior Preparation Center (WPC); Lieutenant Colonel Joseph Thomson, WPC; Lieutenant Colonel Patrick Oliver, WPC; Major Thomas Hill, Exercise Division, Headquarters, USAREUR; Mr. Sam Middlebrooks, U.S. V Corps Simulation Center; Mr. John Crown, U.S. V Corps Simulation Center; and Mr. William Frederic, R&D Associates at U.S. V Corps Simulation Center.

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CONTENTS

FIGURES

TABLE

GLOSSARY

AD	Air defense
ADA	Air defense artillery
AI	Air interdiction
APCs	Armored personnel carriers
ASOC	Air support operations center
ATOC	Allied tactical operations center
AWACS	Airborne warning and control system
AWSIM	Air Warfare Simulation, housed at WPC
BAI	Battlefield air interdiction
BCTP	Battle Command Training Program
BDA	Battle damage assessment
CAS	Close air support
CAX	Computer-assisted exercise
CB	Counterbattery (fires against enemy artillery)
CBS	Corps Battle Simulation (a combat model)
CFX	Command field exercise (command vehicles only)
CG 89	1989 Caravan Guard exercise
CINCUSAREUR	Commander-in-Chief, USAREUR
COSCOM	Corps Support Command
CPX	Command post exercise (no maneuver units fielded)
CS 90	1990 Centurion Shield exercise
CSS	Combat Service Support
C2	Command and control
Daaden	Location of ECC during CG 89
Di-staff	Exercise directing staff
EAC	Echelons Above Corps
ECC	Exercise Control Center
ELINT	Electronic intelligence
ENDEX	Time that an exercise ends
EW	Electronic warfare
FEBA	Forward Edge of the Battle Area
FFRDC	Federally funded research and development center
FLOT	Forward Line of Own Troops
FTX	Field training exercise (all vehicles in field)
G1	General staff section and head of personnel
G2	General staff section and head of intelligence
G3	General staff section and head of operations
G4	General staff section and head of logistics
G5	General staff section and head of civilian affairs
GRWSIM	Ground Warfare Simulation housed at WPC
Guardrail	A specific airborne intelligence sensor
helo	Helicopter
hex	Hexagon--geographical terrain unit in many models
HIMAD	High and medium altitude air defense
ICM	Intelligence collection model
JESS	Joint Exercise Support System (now called CBS)
JSEAD	Joint suppression of enemy air defenses
JWARS	Joint warfighting simulation: AWSIM plus GRWSIM

kms	kilometers
LLTR	Low-level transit route for aircraft crossing FLOT
LRRP	Long-range reconnaissance patrol
METL	Mission essential task list
MILES	Military exercise system
MOE	Measure of effectiveness
NAI	Named area of interest
NATO	North Atlantic Treaty Organization
OCA	Offensive counter air
PLRS	Position locating and reporting system
POC	Point of contact (a person)
POL	Petroleum, oil, and lubricants
Recce	Reconnaissance
REFORGER	Return of Forces to Germany exercise
SEAD	Suppression of enemy air defenses
SF	Special forces
SHORAD	Short-range air defense
SIGINT	Signals intelligence
SLAR	Side-looking airborne radar
SOF	Special operations forces
Spetsnaz	Soviet version of SOF
STARTEX	Time that an exercise begins
TACFIRE	Tactical fire direction system
TACSIM	Tactical simulation, used for intelligence exercise
TAI	Target area of interest
TBD	To be determined
TRAC/FLVN	TRADOC Analysis Center, Fort Leavenworth
TRADOC	Training and Doctrine Command
USAREUR	United States Army, Europe
VIC	Vector in commander (a combat model)
UTM	Universal transverse mercator (map coordinates)
WPC	Warrior Preparation Center, Einsiedlerhof, Germany

1. OVERVIEW

BACKGROUND

Large-scale field exercises, such as those conducted by U.S. and NATO forces in Germany, entail both political and economic costs. Prominent among these are costs of damage to the civilian countryside caused by maneuvering units during field training exercises (FTX). Particularly during these times of reduced international tension, military planners seek methods of reducing these costs while maintaining force readiness.

As a result, alternatives to traditional large-scale field exercises were considered by the U.S. Army, Europe (USAREUR). The alternatives to FTXs include: a command field exercise (CFX), a command post exercise (CPX), and a computer-assisted exercise (CAX). Each alternative training mode has advantages and disadvantages.

An FTX consists of full units maneuvering with all of their assigned equipment and personnel in the field. Units may maneuver anywhere within the terrain box subject to predefined maneuver restrictions. Independent umpires who observe engagements determine results and assess combat outcomes. The advantage is that an FTX is the most realistic training mode for fielded units, since all of the unit's vehicles are in the field, and all of the problems and friction created by moving large units across difficult terrain in adverse weather are present. The disadvantage is that FTX is an expensive training mode in terms of operating costs, maneuver damage, and personnel costs. Moreover, additional maneuver restrictions, designed to reduce maneuver damage costs, have been imposed each year, thereby reducing the realism and training benefit of an FTX.

A CFX consists only of the command vehicles, such as the tank platoon leader or even a tank company leader, so that the number of personnel and vehicles in the field is reduced. This training mode reduces costs associated with maneuver damage, operating, and personnel costs. However, the assessment of combat and maneuver outcomes by the umpires is more difficult, since the umpire must judge whether the tactics of each side could have been implemented as described by the CFX unit commander, rather than having observed their actual implementation as in the FTX mode. In addition, the training of other functional areas may suffer, such as the

training of live intelligence sensors. When only one vehicle is present where 5 or 20 vehicles should be present, the visual cues are significantly reduced, and units are more difficult to detect in CFX.

A CPX further reduces costs by training only the command and staff elements of the participating units, such as battalions and above. This method is even less expensive in terms of maneuver damage, operating, and personnel costs. However, there are also trade-offs associated with the training benefits being applied only to command elements of each echelon.

An exercise that employs a computer as one of its assessment tools is, by definition, a CAX. A CPX that employs a computer to assist in the assessment of outcomes is considered a CAX.[1] CAXs have a number of advantages and disadvantages related to realism, manpower requirements, and costs. The employment of simulations also tends to exercise certain functional areas not usually exercised by traditional training methods. For example, it is difficult in a fully scripted exercise to provide meaningful training to an intelligence staff when all the significant events are predetermined. By contrast, a simulation might be better able to present a useful training experience to the intelligence staff. However, training simulations tend to be somewhat limited in their realism, as we discuss later in this document.

Due to recent advances in computer and communications hardware and software, the U.S. Army decided to perform a test to determine the feasibility of employing combat simulations in support of a large-scale field exercise. The first test exercise was U.S. V Corps Caravan Guard 89 (CG 89) exercise, in which the corps' two reinforced divisions in the field competed against each other (see the description of the battlefield below). In addition, selected elements of the corps staff supported the divisions, with the remainder of the corps being represented by simulated units. The main reason the corps staff elements were included was to determine whether or not the scope of the exercise design could be expanded to encompass two opposing live

[1]In some computer-assisted exercises, the Corps Battle Simulation (CBS) terminals are distributed to the company commanders in a shelter in the field, with remote links into a central computer. In either training mode (CFX or CBS), the company commanders are considered "response cells" since their primary function is to provide realistic inputs to the training audience--the commanders and staffs of their parent battalions and higher echelons. The company commanders themselves may receive "collateral" training, but the main purpose is to support the training of the higher echelons.

corps in the upcoming Centurion Shield 90 (CS 90) exercise, part of REFORGER (Return of Forces to Germany exercise) 90.

Several different modes of training (FTX/CFX and two types of computer-assisted command post exercises) were coordinated for the first time in a large U.S. Army training exercise. The simulations used in the exercise were: the Corps Battle Simulation (CBS) at the V Corps simulation center, and the Ground Warfare Simulation system (GRWSIM) and Air Warfare Simulation system (AWSIM) models at the Warrior Preparation Center (WPC).

A major element of the experiment concerned the choice of computer simulation. The two major candidates were the Corps Battle Simulation[2] and the Warrior Preparation Center system of GRWSIM (a ground warfare combat model) and AWSIM (an air warfare combat model). Each of the two ground combat candidate models presented difficulties. CBS, designed for division-level and corps-level training, was deemed by some as inadequate for the deep and rear operations required for CS 90. The WPC system, which was often used for Echelons Above Corps (EAC) training, was considered by others as not having the resolution necessary for representing the CFX forces. In an attempt to have the best of both worlds, USAREUR decided to employ both candidates, using each where it was best suited.

DESCRIPTION OF THE EXERCISE BATTLEFIELD

The U.S. V Corps Caravan Guard exercise took place from September 13 through 20, 1989. A parallel Air Force live-fly exercise called Cold Fire provided a number of aircraft in support of CG 89, as well as support from an Allied Tactical Operations Center (ATOC). The weather was mild, although overcast skies and some rain did reduce the effectiveness of live aircraft sorties.

There was an effort to play a flank threat in CG 89. Traditionally, live forces competed against each other in the live maneuver area or play box, without threats from outside of their areas of operation. In CG 89, it was decided that there would be simulated units to either flank of the live play box, so that each training audience had the opportunity to train in coordinating with friendly flank forces and handling flank threats.

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[2]Until October 1989, CBS was called the Joint Exercise Support System (JESS).

On the ground, each side (Blue Northland and Red Southland) had one live division (Div) with subordinate units operating in either FTX or CFX mode (see Figure 1.1). Southland's live Blue division was considered Gold in color, since that is the traditional designation of the opposing side when Blue units fight Blue units. Both Blue and Gold units use U.S. or NATO equipment and doctrine.

The west flank was simulated at brigade (bde) level using CBS, with scout platoons to provide the interface with the live portion of the exercise. The east flank of the live play box, the west flank of the CBS simulation box, and the deep and rear battles for all live and simulated units were simulated at the WPC.

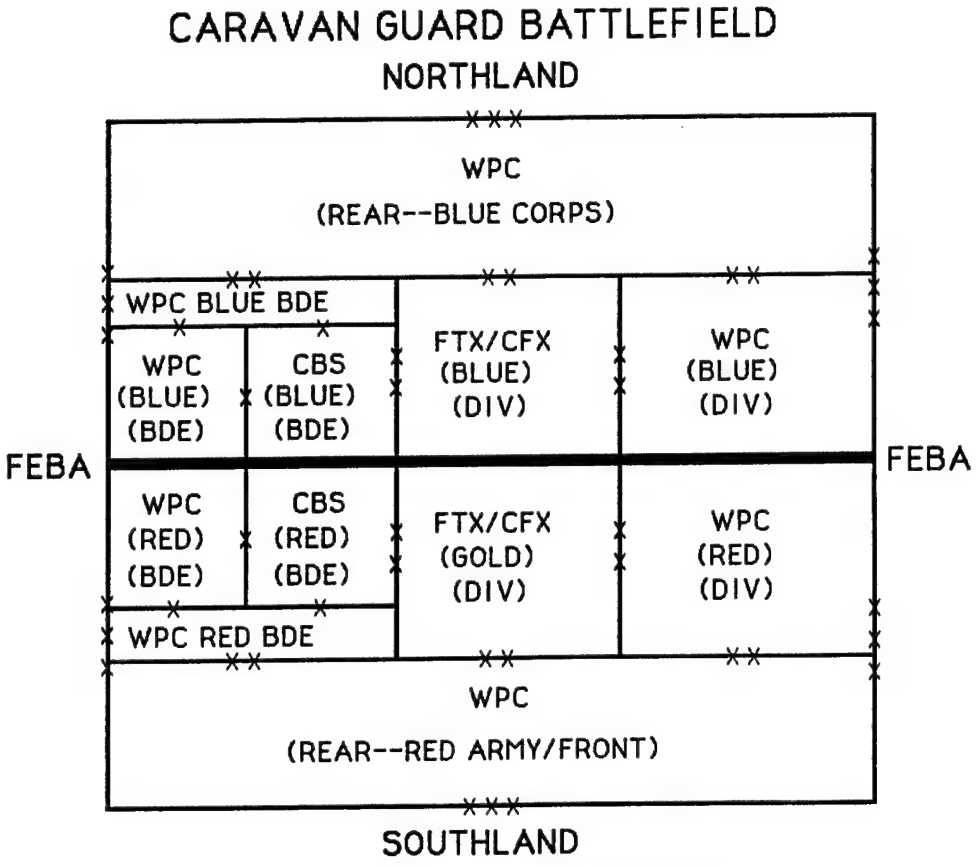

Fig. 1.1—Caravan Guard 89 Exercise Battlefield

Part of the objective of CG 89 was to exercise elements of the corps staff that were not usually exercised, such as the deep operations cell and the rear area operations center. Since CG 89 was a V Corps exercise, only Northland had these cells, and threats were presented to these cells during the course of the exercise. The

WPC GRWSIM model provided an opposing, or Red, threat from Southland to train the Northland deep battle cell. This design was employed in anticipation of CS 90, where there would be two opposing corps, each with deep and rear battle cells to be exercised. Note that in the simulations, Southland employed Red equipment, doctrine, and tactics, while in the FTX/CFX box, Southland employed Blue equipment, doctrine, and tactics.

One of the main objectives of a multimode exercise is to present as "seamless" a battlefield as possible to the training audience and assessment processes. That is, all of the functional area activities in one training mode should be able to interact with the functional areas of the other training modes with no unnecessary artificiality. For example, simulated units should be able to engage in close combat with live units and vice versa. However, this is very difficult to accomplish, even with a predefined set of criteria regarding how the simulated units will interact with live units during an exercise. Similarly, simulated units from each simulation should be able to interact with each other, and live units in different training modes (e.g., CFX and FTX) should be able to interact with each other as well.

If the battlefield does not appear to be seamless to the training audience, the achievement of the training objectives may suffer. For example, if one training objective is to synchronize the close, deep, rear, and flank operations, then the actions in one functional area must interact properly with the actions of the other functional areas. However, if the actions performed in one training mode cannot translate into the other training mode, then units in each training mode are invulnerable to each other, and act as if on separate battlefields. When the seams are obvious between training modes, the resulting artificialities detract from both the realism of the exercise and the achievement of the training objectives.

The sequence of events during CG 89 was planned as follows. During the first week, the Southland forces would attack northward against the defending Northland forces. Then there would be the transition weekend during which the training audiences would reorganize their forces for the second week. During the second week, the Northland forces would counterattack southward against the defending Southland forces. This would allow both primary training audiences to be exercised in both offensive and defensive missions during the course of the two-week exercise.

The transition weekend of this exercise was traditionally performed in the administrative (noncombat) mode. In CG 89, it was decided that the live forces would be reorganized in the administrative mode, but the simulated forces would

continue to fight so that a continuous threat would be presented to selected elements of the corps staff, such as the corps' deep operations cell. The story behind the continuous transition weekend was that each of the live divisions was relieved by a simulated division late on Friday, while late on Sunday the live units would relieve the simulated units on-line.

OBJECTIVE AND SCOPE OF THIS NOTE

RAND's focus during this exercise was on the simulation interfaces, including simulations interfacing with each other and with the CFX/FTX. Therefore, this document focuses only on the technical and functional area issues and relatively broad cost estimates (such as high, medium, or low).[3] Its purpose is to document results and to provide supporting material for future analysis.

This Note does not attempt to address whether the use of mixed modes of training in a single exercise is desirable. There are a number of potential benefits as well as a number of tangible artificialities that occur in exercises that employ more than one training mode. Whether the benefits of mixed-mode training exercises outweigh the costs and complications is a subject reserved for future publications that will consider a broader range of exercises and issues. Similarly, in this document we do not assess the desirability or the costs of employing more than one ground combat simulation in a single exercise.

ORGANIZATION OF THE DOCUMENT

This Note describes RAND's observations of the exercise, starting with hardware and communication links issues and proceeding through the primary military functional areas as represented in the simulation software. Some issues overlap many functional areas, but each issue is listed under the most dominant functional area. In each area, both observations from Caravan Guard and issues for REFORGER 90 are presented.

The appendices include the data collection plans and requests employed during the Caravan Guard exercise. These are included in this Note to serve as a guide for data collection during similar exercises in the future. Appendix A outlines a data

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[3]A companion Note, Patrick Allen et al., *Observations of Centurion Shield 90*, RAND, N-3152-A, 1992, provides similar information on the next exercise in this series (CS 90). Broader issues of simulation effectiveness and the design of future exercises are considered in Patrick Allen, *Simulation Support of Large-Scale Exercises: A REFORGER Case Study*, RAND, R-4156-A, forthcoming.

collection plan focusing primarily on the interfaces among the simulations and the FTX/CFX live play. Appendix B outlines specific data requests made prior to the Caravan Guard exercise.

2. HARDWARE AND COMMUNICATION LINKS ISSUES

This section presents four issues related to hardware and communications links. Although the communications links, the simulations links, and the simulations were operating correctly throughout most of the exercise, there are still several areas that will require improvement in future exercises.

SIMULATION DOWNTIME

Issue 1: Simulation downtime can be reduced in future exercises.

At the start of the exercise, the FTX and CFX components started on schedule. Both of the simulations (GRWSIM at WPC and CBS at V Corps) suffered significant delays in getting started due to a variety of coordination, database, software, and linkage problems. Estimated downtime for each simulation was about 10% of the exercise time due to database (WPC) or linkage (CBS) problems, most of which occurred at the start of the exercise. (This is in addition to the 10% satellite link downtime that mostly occurred toward the end of the exercise.)

Discussion: Northland's right flank consisted of one division, of which one brigade was modeled in CBS, and two in the WPC. During the course of the game, the control of the simulated reserve brigade of each side was supposed to be manually passed from WPC to CBS. This handoff required that all of the "shared" units represented in each simulation be identical, but this was not the case at the start of the exercise. The initial lay-down was supposed to have one WPC-controlled brigade on-line, but this was not implemented. Confusion coordinating which simulation initially controlled which units and their relative locations required the simulations be restarted. Delays in the simulation support of the exercise lead to apparent "seams" between the training modes, thereby reducing the realism presented to the training audience, thereby affecting their training benefit.

Recommendation: An early start-up and training phase for all simulations, two or three days before FTX/CFX start, would help ensure that:

- the simulations are ready to go on the first day of the exercise,
- simulation players have had adequate training to familiarize themselves with the simulations,

- interfaces and data exchange issues are worked out,
- databases are compatible with all appropriate units represented, and
- a more detailed buildup of intelligence information is available before the start of the exercise.

Although running two or three additional days at the front of the exercise adds to the marginal costs of communications links and personnel operating the simulation, not running the simulations early detracts from the training benefit. As mentioned above, 10% of the time either the simulations or the communications links were down, mostly at the start of the exercise. Having the simulations and links active before the exercise will reduce downtime during the exercise.

COMMUNICATIONS LINK DOWNTIME

Issue 2: Communications link downtime and interrupts were severe.

Discussion: The WPC/CBS satellite link was down for just over 10% of the exercise time due to hardware or software problems.

Sept. 18 down 1300-1630 due to bad waveguide at Daaden.[1]
Sept. 19 down 1045-1325 due to fiber-optic modem at WPC.
Sept. 20 down 0800-0930 due to crypto-key errors.

Short breaks in the communication link were not a serious problem for the videoteleconferencing sessions. However, these same short breaks tended to cause the player terminals to become automatically logged out. This was especially true for the corps' intelligence cell players, who could have multiple breaks within an hour, thereby wasting time logging back on again. In addition, the deep battle play was severely hampered by intelligence data not being received from WPC due to these communication lapses. Reliable communications links will enhance the training benefit by ensuring that the actions taken in one functional area are assessed in a timely manner with respect to all the other functional areas. Otherwise, training objectives such as synchronizing the deep and close operations cannot be met.

[1]The exercise control center (ECC) was located at Daaden, Germany. This is where the central CBS computer was located, as well as the FTX and CFX central control station.

Recommendation: Set up a reliable communications system that includes backup systems. Options include both commercial satellite or commercial phone lines. Alternative communications channels for REFORGER 90 are already under investigation by the WPC and personnel at the V Corps simulation center. These personnel are responsible for determining the trade-off between the costs and reliability of these options.

INFORMATION EXCHANGE BETWEEN MODES

Issue 3: Improve the information exchange among training modes.

Discussion: Unit location information was not being passed properly between CBS and WPC. The program at the WPC end of the link had an error in the "convert" function, causing UTM (Universal Transverse Mercator) coordinates not to be translated properly into game hexes.[2] This resulted in confusion as to the perceived frontage of the battlefield as well as unit locations. For example, the Red cell at the WPC perceived a 90 km simulated frontage, while the Blue cell perceived a 75 km frontage. This led to a number of occurrences where Red units exceeded the exercise boundary limits and obtained an unrealistic advantage over the Blue forces on the east flank. Other data transfer errors caused subsequent errors in separate data files. Most of these data transfer problems were solved by the end of the exercise, but they created severe problems early in the exercise.

Recommendation: There are three items that could assist in solving these issues:

- An early start-up and training phase in the simulations would help ensure that the simulations are ready to go on the first day of the exercise. Starting the simulation a day or so earlier would help ensure that such basic errors do not occur when the FTX/CFX starts.[3]
- A fully automated interface between CBS and the WPC models would be preferred over the manually intensive process originally envisioned for Caravan Guard. By fully automated, we mean that selected data are

[2]The GRWSIM and CBS combat models employ a hexagonal grid on the game map to represent terrain features. A game hex is one hexagon of the game map.

[3]Apparently, this is already standard operating procedure at V Corps Simulation Center.

passed automatically between the two simulations on a regular basis, rather than attempting to link all of the data in each model with the other. The former option is much less expensive than the latter option. It is our understanding that this issue is being worked on, and experimentation to date has been promising. In addition to passing unit information, changes in unit boundaries should also be passed through the automated link.

- It would help to have the simulations automatically display which units are controlled by which box (FTX/CFX, CBS, WPC). Currently in the GRWSIM model, one can manually initiate the highlighting of units by chain of command. However, a useful feature would be to automatically highlight units differently for each training mode. This option is inexpensive, requiring that the WPC simulations highlight units from different training modes with unique colors. The benefit would be to quickly identify where problems between the different training modes arise, so that they can be solved before they detract significantly from the training benefit.

SINGLE AUTHORITY TO MONITOR SIMULATIONS LINKS

Issue 4: Single authority needed to coordinate simulations.

Discussion: After the control of elements of two Red divisions were passed to CBS from WPC, they began appearing on the WPC screen as behind the Blue lines on the opposite side of the battlefield. No one was sure whether this was planned or another example of the convert program bug. Blue simulation players began to target these Red units in their rear. A central point of contact (POC) for simulations could have quickly determined whether or not this was an intentional act or a program error.

Recommendation: A single control point should speed the resolution of communication, simulation, and interface problems, thereby reducing the effect of simulation problems on the training audience. Having one person responsible for coordinating the information available on the two simulations is not expensive, since one person discovered the problems described above. The key is having a terminal from each simulation available at the same location, such as the exercise control

center, with phone lines to the person in charge of each simulation. No additional terminals or simulation links need to be added to the exercise. The recommendation is to have a knowledgeable person responsible for keeping an eye on the simulations, and give that person direct access to the person in charge of each simulation.

3. ISSUES BY FUNCTIONAL AREA

Observations on the simulations and the interfaces among simulations are organized below by functional area. In some cases there is overlap, since the activities of one functional area often interact with those of another functional area. We examined the interfaces between different training modes in a single functional area, as well as the effects of the training modes between different functional areas. The functional areas examined during this exercise were:

- Unit resolution (and passing information back and forth)
- Command and control
- Air
- Air defense
- JSEAD
- Electronic warfare (Signals Intelligence, Electronic Intelligence, and Countermeasures)
- Threat play
- Intelligence
- Corps picture
- Deception
- Deep battle
- Rear battle
- Fire support (non-air)
- Attrition rates
- Maneuver
- Combined arms
- Engineers
- Combat service support
- Special Operations Forces (SOF), Long-Range Reconnaissance Patrol (LRRP), and Spetsnaz
- Airborne/Air assault

UNIT RESOLUTION

Unit resolution is the term applied to the size of the unit represented in a given simulation. For example, if a model represents companies and platoons, the model's unit resolution is at company or platoon level.

The unit resolution between the CBS and WPC models appeared roughly equivalent at the FLOT (forward line of own troops) with company-sized teams represented in both models. Units away from the FLOT were represented in CBS as larger formations (battalions or regiments, depending upon distance from the FLOT). CBS can disaggregate the units as they approach the FLOT. It is not clear that units need to have the same level of resolution in both models, but it might reduce some potential confusion. A consistent set of rules should be used in each simulation for each area of the battlefield (FTX/CFX, deep, rear, flanks, etc.), and these rules need to be defined well before the start of the exercise. This will ensure that all affected participants (including intelligence personnel and controllers handling the interfaces among simulations) understand the differences between different unit resolutions.

Issue 5: Updates across the interfaces need to be more consistent.

Discussion: Different unit resolutions among the training modes created difficulty in presenting a "seamless" battlefield. The WPC/CBS interface passes unit information back and forth every 30 minutes. The FTX/CFX interface with the simulations (in this case CBS) occurred every four to six hours. This resulted in major gaps in the data available to the higher-echelon simulation players as to what is occurring in the FTX/CFX box. This created problems both for model control as well as for the play of intelligence collection.

Note that not being able to accurately track real unit locations affected the assessment process, and therefore affected the play of the exercise. It is understandable, and even desirable, that there be location uncertainty during an exercise, since that is a real-world situation. Unfortunately, when the uncertainty is associated with the training modes and affects the simulation assessment processes, the presentation of the results to the training audience suffers, and then the exercise's realism suffers.

Recommendation: This issue is difficult to solve, since the actual location of units on the ground is difficult to obtain without using a system like the Position Locating and Reporting System (PLRS). It is unlikely that sufficient PLRS

equipment would be available for REFORGER 90.[1] Although none of the following options will adequately address this problem, these three options should be considered for improving this interface:

- Increase the frequency of the umpire updates. This may be difficult given the data collection process from the field.
- Rely more on reporting from each side's command and control picture, since the unit's knowledge of its location is probably as good as the umpire's. This option will also have problems, since higher echelons often know the current location of only half of their friendly units at a given time.
- The use of liaison officers and flank scout platoons could help update at least the flank units in the FTX/CFX box for reporting location data to the simulations.

COMMAND AND CONTROL

Issue 6: The unified live and simulated command and control (C2) structure was not well understood early in the exercise, leading to confusion and limiting the training benefit.

Discussion: The whole chain of command of who reports what to whom was not well defined early in the exercise. For example, the VII Corps' response cells at WPC called up V Corps for intelligence reports on the FTX/CFX and CBS boxes, but these requests were not expected at the V Corps.

Note from Figure 1 that the live and the simulated command and control chain of commands were supposed to be fully integrated to present the image of a seamless battlefield. Therefore, it is important that both the live and simulated commanders know whom to contact and how to contact their counterparts. If this is not accomplished, then the training audience is fragmented, the coordination of actions among functional areas is degraded, and therefore the training objectives may not be met.

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[1]During Operation Desert Storm, there was a proliferation of global positioning satellite receiver systems. This new option may allow for a sufficient number of "pocket" position locators to be available for exercise purposes, thereby alleviating the problem of actual unit locations for exercise assessment purposes. This option appears to be better than the three options presented since it is the least expensive and most effective.

There is, of course, concern that opposing players will attempt to cheat by calling an opposing cell to obtain information leading to an unfair advantage. This latter problem will be addressed in the recommendations below.

In another example, the Red Front commander was being given tasks both by the exercise directing staff (Di-staff) and by subordinate commanders from the CBS and FTX/CFX boxes. Such direction from subordinates is not in line with representing a single chain of command on a seamless battlefield. Confusion about the exercise chain of command will be an even more difficult problem when two Red commanders will be playing the WPC forces in the deep battle area against the two Blue training audiences. (See Threat section, below.)

Recommendation: Before the start of the exercise, ensure the answers to the following:

- Who is the training audience (including specific persons by name, simulated position, simulated rank, and exercise phone number)?
- What are the specific tasks for which each training audience is being trained? Also specify tasks for which the training audience is not being trained, so that expectations are prepared ahead of time.
- Identify training support personnel, and whether or not there is any collateral training being attempted. Once again, preparing expectations ahead of time is important.
- Who is in charge of information flow into and out of the training audience? To ensure that the training objectives for each cell are being met, there needs to be a focal point to monitor information flow into and out of each training cell.[2] This one point of contact, knowledgeable about all of the sources of information entering a given cell, will be able to distinguish between errors, artificialities, and intentional events encountered by the participants. The ability to contact a person knowledgeable about the current training plans is essential to prevent negative training from occurring.

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[2]The use of a training support person in each cell is closer to the concept of the observers and evaluators in the Battle Command Training Program (BCTP). Such a requirement is very manpower intensive, and may not be a viable option in many exercises due to the high cost and limited availability of qualified evaluators. However, whenever such personnel are used in a training cell, the training benefit is likely to increase.

- To ensure that each information request is coming from a valid source, one may attempt to perform simple "authentication" procedures. This ensures that staffs are practiced in these procedures for unsecure communications channels in the event of an actual conflict. This may be done only on an experimental basis, rather than for the whole exercise. If this requirement is considered sufficiently important, it could be explicitly included as one of the training objectives.

Issue 7: The play of air space management was limited in this exercise.

Discussion: Air space management was practiced for live aircraft, understandably focusing primarily on safety requirements. There was less representation of air space management within the simulations. For example, a limited number of low-level transit routes (LLTRs) were represented, and they were not changed when discovered by enemy air defenses.

Recommendation: Increase Air Force participation to man the key coordination slots and to maintain air coordination issues at a high state of awareness. Since proper use and synchronization of airpower is a vital part of the Army's air/land battle doctrine, training that practices air and ground coordination will enhance Army capabilities.[3] When Air Force exercises are planned to occur at the same time as Army exercises, the cost of additional Air Force personnel to support the exercise is significantly reduced.

AIR

Issue 8 (*)[4]: There was no coordination of air play between WPC and CBS.

Discussion: CBS was flying AWACS (airborne warning and control system) and controlling deep Patriot sites, regardless of what the air situation was at WPC. Therefore, CBS air and air defense assets acted independently of the WPC air and air defense assets. This would not have been as much of a problem if CBS air and air defense assets had operated only in the CBS box and WPC assets only in the WPC

[3]Although this document was originally written before Operation Desert Storm, the value of practicing air and ground coordination has only increased since that event.

[4]An asterisk denotes a problem associated only with CG 89. All other issues are applicable to computer-supported exercises in conjunction with live units in field exercises.

box. This was not the case, however, in that WPC aircraft flew through the CBS box and the FTX/CFX box.[5] As a result, a realistic air picture and the need for air allocation decisions across the entire front and deep areas were not presented to the corps staff.

The modern battlefield is very integrated, and the representation of realistic interactions between air and ground assets is very important with respect to training. How quickly can air support be requested? What are the limitations on its use? How effective will it be in slowing the advance of enemy forces? How does one reduce the probability of fratricide? All of these are important questions raised by a realistic representation of air and ground interactions. Without these types of factors being represented, personnel may be trained to have unrealistic expectations of air support of ground operations.

Recommendation: Coordination of which simulated aircraft and air defense assets will be played in which simulation (and the FTX/CFX box) needs to be preplanned and monitored during the exercise. The added planning required to coordinate the representation of air and air defense assets in the two simulations is not expensive, but does not occur without coordinated planning between the WPC and the CBS personnel.

Even though air and air defense assets in each simulation have no effect on each other, prearranged signals can be created to incorporate the more rudimentary aspects of air defense and JSEAD (joint suppression of enemy air defense) operations. See additional recommendations under the air defense and JSEAD functional areas below.

Issue 9: Limited participation by Air Force personnel created difficulties in air and ground coordination training.

Discussion: There was one Air Liaison Officer available to plan and coordinate mission support. Airspace management training and experience were provided by live aircraft, but not provided by simulated aircraft. See Issues 7 and 8 for a discussion of the costs and benefits associated with increased Air Force participation in Army exercises.

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[5]One of the main problems is that two different air-ground combat simulations are being used to support a single exercise. We address this issue in detail in the final report.

Recommendation: Invite more extensive Air Force participation, including ASOC (air support operations center) and ATOC (allied tactical operations center) participation in direct support of REFORGER simulations if possible. Air Force participation at that level is important for training synchronized air and ground coordination for close operations. In addition, coordinating air support is important for training synchronization of all resources for fighting close, deep, and rear operations.

Issue 10: The number and effectiveness of CAS (Close Air Support) sorties flown in support of the corps battle may not have been realistic.

Discussion: During the live-fly portion of the exercise, the forward air controllers had difficulty handling 30 CAS sorties per day. The live CAS sorties were being moved from contact point to contact point and then sent away without attacking a target. Some of the difficulty in handling these aircraft was due to safety restrictions, but some was due to the need to coordinate the attack of each flight.

Some would argue that 50 aircraft per day is a high density of CAS aircraft in a single corps sector, while others argue that hundreds or even 1000 CAS sorties per day can fly in support of a corps sector. It may be physically possible to fly such a large number of sorties in a day in a corps sector, but the effectiveness of each sortie would be drastically reduced. Rather than being individually controlled, CAS sorties would fly against a geographical area. This means that each sortie runs the risk of not finding a target, or wasting munitions by killing ground targets that are already destroyed.

In simulations, the effectiveness of a given CAS sortie does not vary with the number of sorties being flown in a given period of time. An important real-world constraint is being ignored in most combat simulations, not just CBS, GRWSIM, or AWSIM. If the amount and effectiveness of air support are not realistic in the simulations, then the training benefit provided to the training audience decreases.

Recommendation: Examine the number and effectiveness of CAS sorties that are reasonable in a given corps sector per day, and modify the simulations to reflect these limitations in either the number or the effectiveness of the CAS sorties. This should not require extensive recoding of either simulation, thereby minimizing the cost of the recommended change.

Issue 11: Simulated aircraft are not as restricted by weather as actual aircraft flying in support of the exercise.

Discussion: A significant fraction of actual aircraft missions was canceled due to weather conditions over the target and coordination difficulties. However, simulated aircraft were not subjected to the same sorts of restrictions during this exercise. Simulated aircraft fly and find their targets in spite of the actual weather.

The training objectives determine whether the simulations play realistic or perfect weather in support of the exercise. However, one must understand that some training objectives may be subordinate to other training objectives. For example, one cannot require clear weather for training procedures and realistic weather for training how to handle uncertainty at the same time.

Recommendation: If the focus of training is on air-to-ground mission planning and coordination procedures, then this is not an issue. If the training focus is to present a realistic situation where aircraft may not be able to reach a particularly vital target due to climatic conditions, then this issue needs to be re-examined. One may choose to do both--play the deep battle in simulation most of the time without weather, except during a specified period in which severe degradations due to poor weather are played in the simulation. The result is to force the deep battle cell to consider and plan ahead for alternative deep attack means, such as conserving surface-to-surface missiles for when aircraft cannot fly.

The cost of representing realistic weather in the simulations is very small, since both simulations have parameters that can be set to represent the effects of poor weather. The key is deciding what the weather should be to achieve the training objectives and when the specific types of weather should be activated in the simulations.

AIR DEFENSE

Issue 12 (*): Air defense assets must be included in the exercise in order to balance the effects of fixed- and rotary-wing aircraft.

Discussion: The initial intent was for the WPC air and ground models to play air interdiction (AI), battlefield air interdiction (BAI), and high and medium altitude air defenses (HIMAD), while all simulations (including CBS) played close air support and short-range air defenses (SHORAD) in their own boxes. Due to coordination problems associated with the initial exercise plan, air defense assets were being played in CBS, but no air defense assets were played in the WPC simulation at the start of the exercise. As a result, the effects of most CAS and BAI air missions in GRWSIM were found to be devastating in the low air defense environment. Therefore, the decision was made to include air defense assets in both simulations, but not in the FTX/CFX box. This improved the situation somewhat, but then there was no opportunity to play joint suppression of enemy air defenses across the different training boxes. In addition, aircraft flying in CBS were not affected by WPC air defense assets, and vice versa.

Recommendation: Plan to include air defense assets from the beginning. Coordinate how to represent air defense assets in both the WPC and CBS at the same time (including the area involving the FTX/CFX). For example, one can duplicate the air defense assets in the WPC and CBS models so that aircraft flying in either box in either model are facing an equivalent threat. The location of air defense units in the ground models may be passed along with other unit locations. (SHORAD asset locations and status must be passed separately to the WPC air model, AWSIM.) If possible, there should also be shared constraints on air defense munitions stockages and resupply activities. In addition, suppression of air defenses can be performed by controller action. (See JSEAD below.)

The cost of duplicating the air defense assets in each simulation is very small, since data input by experienced personnel is relatively quick and easy. The difficult part is deciding the order of battle on each side, and coordinating the representation of that order of battle in each simulation.

JSEAD

Issue 13: No JSEAD was played in the simulations.

Discussion: It was decided before the start of the exercise that no JSEAD operations were to be represented in the simulations. Therefore, the air defense assets that were played were not suppressed during the exercise. For future exercises, the opportunity to train for the planning and coordination of JSEAD missions in an interactive environment is available through simulations.

Recommendation: If the training focus does not include training JSEAD procedures, then prepare the player expectations before the exercise. If JSEAD is part of the training focus, then attempt the following improvement. Represent the air defense assets in all training boxes within both simulations, so that all such assets are represented in each simulation. When a JSEAD mission is planned, use the simulation "control knobs" to reduce the effectiveness of targeted air defense assets in both simulations for a specified period so that aircraft flying during that time in either simulation will obtain a temporary advantage. This will not be a frequent event during a short exercise, since the proper planning of a JSEAD operation takes a significant amount of time. However, the cost of implementing a small number of controller actions coordinated between two simulations is very small.

ELECTRONIC WARFARE (SIGINT, ELINT, AND COUNTERMEASURES)

Issue 14: Electronic Warfare (EW) was not played in the exercise.

Discussion: In addition to no JSEAD, the decision was made before STARTEX (start of the exercise) that there would be neither representation of detection nor representation of subsequent targeting of electromagnetic emitters in this exercise. Therefore, tactical radars associated with fire support could operate without penalty. There was no penalty for not following good emission control procedures.

Recommendation: The simulations do not appear to represent EW effects except for some air and air defense EW activities at the WPC. This is one area where the expectations of the participants need to be prepared before the exercise. Some monitoring of the electromagnetic spectrum may be accomplished in the FTX/CFX so

that appropriate responses can be employed in that training mode, as has occurred in some earlier REFORGER exercises. However, including a good representation of EW in simulations is an expensive undertaking. Preparing the expectations of the training audience before the exercise is much less expensive.

THREAT PLAY

Issue 15: The deep battle cells need to be opposed by a Red force deep and on the flanks.

Discussion: Northland's corps intelligence and deep battle cell was faced by a Red force approaching the FLOT, but Southland's was facing a Blue threat deep. In order to train both corps staffs in deep battle operations during REFORGER, each will need to be presented by a Red threat deep and on the flanks.

Recommendation: The WPC has already made a suggestion to play two overlapping Red and Blue games, so that each side is facing a Red opponent on the flanks and in the deep battle. At the moment it appears to be the only available option, even though it has never been done before. However, this process must be carefully monitored to ensure that the picture is consistent for both corps staffs. Even when employing model control moves, it will be very difficult to present a consistent picture to both corps staffs, since there is no automated way to guarantee that both games will produce similar results. This is especially true of the deep battle, where some coordination is desired between Blue and Red divisions being committed. This coordination is planned to be performed manually. Note that this option will also double the number of players required to represent the threat deep and on the flanks, thereby doubling the costs of personnel required to operate the simulations.

Issue 16 (*): The initial deployment of Red forces did not match Red doctrine.

Discussion: Red forces were placed on the GRWSIM map without regard to doctrinal formations. As a result, many Red units were already in combat before the formations were sorted out by the players. (Note: Many Blue units suffered a similar problem in the flank play.) In this type of exercise, which is predominantly free play,

poor initial starting locations can severely handicap the ability of the threat to present a credible opponent, or for the training audience to adequately handle the threat.

Recommendation: Ensure that personnel knowledgeable in threat doctrine place units before STARTEX. In addition, verify unit locations prior to the start of the exercise. There is no additional cost of implementing this recommendation, since it was supposed to have occurred in CG 89. One way to ensure that this is accomplished is to start the simulations a day or two early to work out any remaining unit location errors as part of the player familiarization and start-up period.

INTELLIGENCE

Issue 17: The intelligence collection model (ICM) provides too much information for this application.

Discussion: The ICM model was originally designed for providing fused intelligence information to players, thereby performing the intelligence analysis function. However, in an exercise like Caravan Guard or REFORGER, it does not provide intelligence analysis training to the corps intelligence staffs. For example, side-looking airborne radar (SLAR) reports give unit location and identification. This is not an accurate representation. At best, the number of vehicles at the location would be reported by that type of asset.

There is an alternative mode of tasking each sensor in the ICM model so that it produces "raw" data, such as the number of tanks, tubes, or armored personnel carriers (APCs) detected, rather than unit identity. However, the decision to operate in the raw data collection mode must be made each time a sensor is tasked. Therefore, it is difficult to preclude the intelligence analyst from obtaining fused data from the model either by intent or by accident.

If one of the training objectives is to train the intelligence analysts, then a better representation of the intelligence functional area is required. If the intelligence staff is not supposed to be trained in an exercise, then it needs to be trained in how to be a better response cell by providing intelligence reports with uncertainty to the training audience, rather than nearly perfect intelligence reports. The purpose of a response cell is to act as a buffer between the artificialities of the training mode (such as too much information) and the training audience so that the training environment is realistic and the training objectives can be met.

Recommendation: If the intelligence staff is not considered part of the training audience, then it must be prepared to be a response cell in support of the training audience. If the intelligence staff is considered part of the training audience, then a more realistic representation of the intelligence functional area is required. Instead of the fused data collection mode, the raw data collection mode of the intelligence collection model should be used to train intelligence analysts. Procedures for ensuring that the intelligence cells do not use the fused mode should be employed. If possible, an automated way to preclude unauthorized use of the fused mode should be created in the code, but the cost of such a change is not known. Due to other limitations of the intelligence collection model, a better model for training intelligence analysts appears to be TACSIM (tactical simulation), as suggested by both the WPC and the V Corps simulation center. (See issue number 19 for more discussion of this topic.) The cost of employing TACSIM is higher than that of employing less-detailed intelligence simulations due to the increased detail and increased classification. However, the increase in cost may be worth the increased training benefit.

Issue 18 (*): Sensors are reporting data in ICM that were not tasked by the collection center.

Discussion: If the intelligence collection management cell tasks only a photoreconnaissance, then it should not receive data collected from Guardrail. If the collection management group does not task the proper assets, they should not be given the data.

Recommendation: Filter the intelligence collection model report so that the report of a given type of sensor is passed only if those types of sensors were tasked. Once again, the TACSIM model apparently has some advantages in this area. At the very least, intelligence personnel as a response cell should be filtering data available from the simulations so that only the type and degree of data that could have been collected given the tasking are made available to the training audience. The main problem appears to be that the exercise design does not clearly specify whether the personnel in the intelligence cells are part of the training audience or part of a response cell. Making this point clear would reduce the confusion, increase the exercise realism, and increase the training benefit. The cost would be small, since it simply involves clarifying personnel tasks.

Issue 19: Intelligence collection and reporting should be balanced for both sides in the exercise.

Discussion: The focus of intelligence play was on training the Northland deep battle staff. Therefore, while Northland was getting good intelligence reports and data collection during the course of the exercise, Southland was receiving very little. This resulted in an exposed flank for Southland that would probably have been detected much earlier. Had this been a traditional single-mode field exercise, the intelligence collection capabilities of each side would have been balanced. The introduction of simulations into the exercise increased the disparity between live and simulated intelligence capabilities, especially along the seams between training modes.

Recommendation: Ensure that the intelligence capabilities are equivalent for both sides during the exercise, especially since both sides will be playing against a Red opponent deep. One way to ensure this is operational at the start of the exercise is to start the simulations a day or two before the FTX/CFX.

One shortcoming of the TACSIM model (see above) is that it is designed to train Blue intelligence analysts and is not designed to reflect Red threat intelligence collection. Therefore, if TACSIM is employed to train Blue analysts, the intelligence collection model provided for the Red threat must be comparable so that neither side has an unrealistic advantage. An unrealistic advantage in intelligence data provided to the threat cell could lead to the training audience being always one step behind the enemy simply due to a simulation artificiality.

Issue 20 (*): Intelligence data tended to come in large bundles rather than spread out over time.

Discussion: When the GRWSIM game was stopped for the night, the clock was moved forward to the next morning. As a result, all of the prescheduled intelligence collection accumulated during the night appeared in front of the intelligence cell players the following morning. In the real world, intelligence information is being generated and received by the intelligence staff throughout the night.

Recommendation: There are two recommendations, depending upon the exercise design. If the exercise is played 24 hours a day, then the simulations should also be played 24 hours a day. This will remove the problem described above. If the

simulation will only be played during the day, move the game clock ahead at the end of the day (rather than the next morning) and provide the intelligence data to the training audience in smaller chunks throughout the night. There is no increase in exercise cost since the running ahead of the simulation occurred the next morning anyway. This will restrict somewhat the game controller moves that occur each night in the simulations, but may provide better training to the intelligence staffs. (Note: The same bundling of data occurred whenever the simulation or the communications link went down, but there does not appear to be a protection against that except to have backup communications and manual intelligence reports if the simulation or the communications links go down.)

Issue 21: Intelligence collected in the simulations can seriously contradict data collected in the live box by live assets.

Discussion: Units in the FTX box may be detected by live intelligence assets at any time. However, the live unit locations are updated in the model only every four hours. When the intelligence collection model is run, it collects only very old data due to an artificiality in the data passing from the live box to the simulations.

Recommendation: There are several options available. The first is to ignore the issue and let the intelligence analysts sort it out. This is easy to accomplish, assuming sufficient qualified personnel are available, but the analysts should be warned ahead of time that this type of artificiality is to be expected when simulated reports mention units in the live exercise box. One could also attempt to obtain updates from the field more frequently, as mentioned earlier. In addition, the use of the liaison officers and the flank scout platoons could help sort out conflicting reports. Another option might be to "filter" units in the FTX box from the ICM outputs so that this duplication does not take place.

Issue 22 (*): There was confusion on the availability of Battle Damage Assessment (BDA) data.

Discussion: After a deep area attack, the corps staff expected to automatically receive AWSIM BDA information from pilot reports. They had not been informed that they had to specifically request reconnaissance missions for BDA until well into the exercise.

Recommendation: The deep battle players need to be aware that the AWSIM does not automatically produce BDA reports from simulated pilots, and that players must explicitly request BDA reconnaissance missions for each ground attack mission.[6] The cost of implementing this recommendation is small, since one is simply preparing the expectations of the training audience and response cells.

CORPS PICTURE

Issue 23: Although the corps picture was not seamless, it provided a significant increase in training opportunities.

Discussion: One objective of the exercise was to present a seamless picture to the corps commander and staff to force their attention away from the FTX/CFX. Although the corps commander and staff (except for the deep battle cell) still spent more effort on the FTX/CFX box, the overall effect was positive. In particular, the creation of an exposed flank on Southland's right in the simulation caused the FTX/CFX Southland units to withdraw. As far as the authors are aware, this had never been accomplished before in a field-training exercise--a computer-generated flank event outside the FTX/CFX box having an effect on the live exercise.

Recommendation: The use of the liaison officers and the scout platoons on the flanks will improve the sense of realism of the simulated forces with respect to the FTX/CFX forces, and vice versa. Not only will they be able to verify unit locations, but they can also prepare overlays to present the commander's intent for adjacent units. This is essential to good planning and coordination between adjacent units and is an excellent training opportunity. For example, a simulated division staff (not including the number of personnel required to run the simulations) could be represented by a few personnel: One person to provide communications from the G2/G3 functions of each brigade, one person to represent communications to or from fire support elements (including artillery and air support), and one to provide communications from logistics and personnel functions. This number of personnel would have to be doubled if two shifts are required for 24-hour-a-day coverage.

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[6]Note that in the real world, the pilot reports are produced, but these reports go to the air units, not to the corps staffs.

The cost of the additional personnel to adequately represent person-to-person communications between adjacent units must be compared with the increased training benefit provided by such contact. Trade-offs between the training objectives and the exercise constraints define the decision parameters. To the extent that seamlessness is taken as a necessary condition for a successful mixed-mode exercise, the ability to provide an apparently seamless battlefield to the training audience is questionable. This is a major issue whose analysis goes beyond the scope of this Note, although conclusions will be presented in the final report.

DECEPTION

Issue 24: There did not appear to be any deception played in either simulation.

Discussion: There were a couple of experimental attempts to play decoy units in the CBS model, but it led to more artificialities in the play of the game. As a result, more deception was not attempted.

Representations of deception operations, such as plans prepared by the corps staffs, can be implemented with little additional cost. However, the realistic representation of deception operations in simulations comes with a wide range of price tags. For some types of deception operations, the simulations adequately assess the planning, execution, and effects of such operations. For example, an air feint used to pull air defenders off of combat air patrol stations and strip alert can be adequately represented in the AWSIM model. Therefore, this type of deception operations is inexpensive to exercise. Conversely, other types of deception operations are less well represented in current simulations, such as the creation of a false brigade headquarters to replace a real brigade headquarters that is moving out of the area. The cost of implementing the latter types of deception operations in the current suite of simulations could be very high.

Recommendation: The most important aspect of including deception in the training environment is to include it early in the planning process. Then, the most important aspects of deception could be included in the exercise. In addition, the simulations need to investigate methods by which attempts at deception might be represented with few additional artificialities. These proposed representations of deception in the simulations will not be ready for REFORGER 90, but may be

available for future REFORGERs. Furthermore, deception entails much more than false targets or phony electronic emissions. There is a significant operational component to deception that has not been attempted in most exercises, which could be investigated during future exercises. If there are inexpensive deception operations that are in line with the training objectives, then these should be encouraged in an exercise. The more expensive types of deception operations will have to wait until the simulations have improved sufficiently to adequately assess these types of operations.

DEEP BATTLE

Issue 25: The deep battle cell was sufficiently stressed, but the rear area movement of enemy forces was sometimes unrealistic.

Discussion: The corps intelligence and deep battle cells defined named areas of interest (NAIs) and target areas of interest (TAIs) according to doctrinal movement norms. However, the movement rates in GRWSIM allowed large units in the rear area to move much faster than their norms would imply. As a result, when the next set of intelligence reports appeared, the enemy forces in question had not only passed the NAI, but also the associated TAI. Therefore, the accomplishment of the training objectives was hindered by simulation assessment processes that were unrealistic and violated agreed upon norms.

Recommendation: Coordinate ahead of time on the Red movement norms, so both the corps staff and the simulation players expect the same magnitude of movement rates. Even though there are NATO agreed upon norms, *the movement rates of small units in a model do not automatically aggregate into the proper large unit movement rates.* For example, a company-sized unit may move at 25 kms per hour. When all of the companies in a division move in the simulation, the average divisional movement rate is about 20 kms per hour. However, real-world divisional movement rates are more like 10 kms per hour or less. Some procedural techniques could be employed to help keep large unit movement rates realistic. For example, controllers could enforce doctrinal rest stops on the Red players moving second and third echelon units.

If the simulations, or the use of the simulations, can accurately represent aggregate unit movement rates, then the training objectives that depend upon these

rates (such as training the deep battle) are more likely to be met. Since representing the aspects of friction in a simulation can be very expensive (depending upon the simulation), we recommend the use of the less expensive procedural techniques to ensure that the doctrinal norms are used during the exercises.

NOTE: We were very impressed with the Program Evaluation and Review Technique (PERT) chart prepared by the deep battle staff. We also recommend following up on that procedure, especially with Air Force cooperation.

Issue 26: When units are entered into the simulations during the game, additional artificialities are introduced.

Discussion: When the third echelon army of Red was entered on the game map, it was entered far ahead of where it had been anticipated. Therefore, the NAIs and TAIs associated with their arrival were obsolete due to an artificiality in the simulation. Once again, the training benefit and the opportunity to achieve the training objectives of the deep battle cell were significantly hindered by this artificiality.

Recommendation: Agree ahead of time where the units will be "entered" into the simulations so they do not seem to the deep battle cell to "teleport." This does not entail additional cost, since all of the steps required to enter the unit into the battle area were already expended during the exercise. We are simply recommending better coordination during the exercise planning process.

Issue 27: The deep fire assets available to the deep battle staff need to be defined before the start of the exercise.

Discussion: There appeared to be a reliance on air assets to perform deep attack missions. Special Forces (SF) or Ranger assets were not represented in the deep battle.[7] Lance assets had been given to the divisions and sometimes used in the close battle. This problem is an issue more associated with distinguishing between the training audience and the training support or response cell personnel. Since some of the personnel in the response cells were told that they were part of the training audience, they played to win, and "gamed the game" as necessary to achieve

[7]It is true that the primary mission of SF and Ranger assets in support of conventional operations is target acquisition, but one could also employ them in direct action against deep targets in extreme circumstances.

victory. Had it been made clear to them at the start of the exercise that their primary mission was training support, then they would have buffered the training audience from the artificialities of the simulations, rather than having used high-value assets on low-value targets.

Recommendation: Remind players ahead of time of the types of assets available and of their associated strengths and limitations. For example, the Lance missiles should be conserved for use in the deep battle, especially if the weather restricts the use of aircraft against deep targets. Lance could also be used as part of the JSEAD operation. In addition, it should be clear to each training element whether they are primarily part of the training audience or are part of the training support (response cell) personnel.

REAR BATTLE

Issue 28 (*): There is a potential disconnect between the two deep battles played by Blue and the two rear battles played by Blue in REFORGER 90.

Discussion: Blue's deep battle cell observes enemy movements in the rear and targets them for delay and disruption at appropriate times. The Blue rear battle is designed to keep the freedom of action of Blue forces open and unhindered by enemy actions. In REFORGER 90, it is anticipated that each corps will be playing a Red opponent. Will Blue V Corps' deep actions affect Blue VII Corps' rear areas? If so, how will one distinguish between Blue and Red actions in the rear area? If not, will V Corps' deep actions have any effect on VII Corps' forces arriving at the FLOT?

Recommendation: Carefully examine which actions by which cell (Blue V Corps' and VII Corps' deep and rear cells, and the threat cells facing V and VII Corps) will affect other cells, and the manner in which these effects will be applied. It may be that as long as no simulated forces arrive in the FTX/CFX area, there is no problem playing two separate rear and deep battles. However, this needs to be determined and understood ahead of time. Otherwise, the training benefit will suffer, and the significant additional cost of supporting two overlapping games will have been wasted.

FIRE SUPPORT (NON-AIR)

Issue 29: The counterbattery representation needs to be improved across all training modes (FTX/CFX, CBS, and WPC).

Discussion: There was no counterbattery (CB) fire represented in the live exercise box. CB detections are planned for the 1.3 version of the CBS model, but is not in the current version of the model. It may be possible to manually pass CBS data representing CB detections to the CB cell, which could then pass them to the TACFIRE system. However, there may be some difficulty distinguishing CB fire missions in CBS from other fire missions due to the message-passing procedure. At WPC, CB fires are possible, but if the artillery units are stacked in the same hex with other nonartillery units, each unit absorbs part of the damage. Therefore, the effects of CB fire can be decreased in WPC by stacking nonartillery units in the same hex as artillery units. This feature is not realistic, and reduces the training benefit associated with training good artillery doctrine.

Recommendation: Follow up on the potential ability for CB missions to be initiated through the CBS model. Modify the CBS fire-mission message passing to ensure that CB missions are so noted. Improvements to the WPC model are under way to better account for CB and other target-specific fires, and may be ready for REFORGER 90. If they are not ready for that exercise, players should be instructed to not stack firing artillery units with other types of units. This will help preclude unrealistic degradation in the effectiveness of counterbattery fires. This latter suggestion is the least expensive since no changes to the code are required.

Issue 30: Artillery fire rates should be severely limited by artillery ammunition constraints, but this does not occur in the FTX/CFX.

Discussion: Artillery fire rates toward the end of the exercise were just as high as at the beginning of the exercise. This was true in the FTX/CFX, as well as the simulations, especially for threat forces. In reality, artillery consumption rates tend to start out high and get smaller over time due to the ability of artillery ammunition resupply to keep up with the demand. To better represent the capabilities of artillery and their interactions with the other functional areas, we need to improve the representation of a decreasing artillery fire rate over time in our exercises.

In addition, the artillery fire rates used in the simulations need to be examined for a similar degree of realism. During CG 89, for example, Red artillery consumption was virtually unconstrained. The Red artillery ammunition stockpile was so large that it was never near being consumed. This may be an accurate assumption regarding the total stockpile, but it is not an accurate assumption regarding the Red capability to sustain high fire rates over time, especially after their artillery has displaced forward. Artillery fire rates in the simulations need to reflect the difficulties in constantly providing high rates of sustained fire, especially to artillery units that have recently moved.

Recommendation: Investigate the possibilities of using the CBS and WPC simulations to provide constrained FTX/CFX artillery fire rates. If we assume that the artillery fire rates in the simulations are accurate, then the rates produced by the simulations could be used to limit the fire rates in the other training modes. The costs entailed in this option are small, since the latest fire rate could be passed to the umpires and training audience on a regular basis several time a day.

The simulations should also play realistic constraints on ammunition consumption (especially threat ammunition consumption), to reflect the operational restrictions described above. This option can be implemented either by adding restrictions to artillery fire rates directly in the simulations or by requiring the response cells to limit the fire missions inserted into the simulations. The first option is more expensive but more reliable. The second option is less expensive but more likely to let additional fire missions slip through in spite of the constraints.

ATTRITION RATES

Issue 31: The attrition rates between the CBS and WPC simulations may be significantly different.

Discussion: It has been mentioned (but not yet verified) that the ground combat attrition rates are distinctly different between the WPC GRWSIM model and the CBS model. This issue is under investigation. One of the reasons might be that the two models are calibrated differently. The CBS model is calibrated by TRAC/FLVN (TRADOC Analysis Center, Fort Leavenworth) using the VIC (Vector in Commander) model. There is strong code and database configuration control for the CBS model. The WPC GRWSIM model has been "tuned" to some degree by exercise

participants. While there is configuration control on the GRWSIM model code, there needs to be similar configuration control of the database.

Wide variations in the assessment processes between simulations can create significantly different results on each part of the battlefield. As a result of these variations, the battlefield is not seamless, participants tend to act differently in each part of the battlefield, and the training objectives may not be met.

Recommendation: Continue the attrition comparison investigation to determine the relative attrition rates between the WPC and CBS models. Once the attrition rates have been determined, a decision can be made as to how to proceed. There is no additional cost to continuing with this investigation effort.

MANEUVER

Issue 32: Assessing combat between FTX/CFX units and simulated units did not work well.

Discussion: Based upon the exposed right flank in Southland, simulated Northland units were sent into the FTX/CFX box. Southland responded with live forces, but there was no way to assess the results. Once again, the attainment of a seamless battlefield is not achieved when assets from different training modes cannot react with each other. The result is that friendly forces on different parts of the battlefield act virtually independently, leading to a lack of coordination between friendly forces. If the training objectives include cohesion, synchronization, and the flank battles, then the training objectives may not be met.

Recommendation: There are three options for this issue. The first option is to keep the different types of units in their own boxes. Under this option, FTX/CFX would remain in their box, while CBS units should remain in their box, and WPC units should remain in their box. It is relatively easier to pass control of units between WPC and CBS, but the differences in each model's assessment processes may lead to more artificialities. At least one should keep the effect of live units being forced to react to flanks exposed to simulated units, as demonstrated in this exercise. (See the earlier section on the Corps Picture.) However, this option almost formalizes a "seamed" battlefield.

The second option is to continue to experiment with interfacing the different simulations with each other and with the FTX/CFX. If this option is selected, a list

should be prepared of the specific areas where interactions will be allowed, as well as areas where interactions will not be allowed. Since this option is currently under way, there are no additional costs for continuing with this option for an interface that passes limited amounts of data between simulations. If one attempts to undertake a full connection between all functional areas in each simulation, this is a very expensive undertaking.

As a third option, it may be possible to use a "live" unit not currently involved in the exercise to act as an inserted simulated unit, but this is a potentially expensive proposition. (During planning for Caravan Guard, it was suggested that the flank scout platoon be used as a CFX threat inserted from the simulations into the flank of the FTX/CFX box.[8])

COMBINED ARMS

Issue 33: Straight leg infantry is not well represented in the simulations.

Discussion: There is no benefit in either simulation to leg infantry fighting in rough or urban terrain, even without special "light infantry" tactics. As in most simulations, infantry is penalized for not having the "combat power" of armor, in spite of prepared defenses, antiarmor capabilities, or being in rough or urban terrain. This is in spite of the fact that only infantry can take and hold terrain. As a result, simulations are generally biased against leg infantry. Fortunately, leg infantry did not appear in either simulation in this exercise.

Recommendation: In the short run, represent leg infantry only in CFX/FTX, where the leg infantry's strengths and weaknesses can be appreciated. There may be some work required to umpire between FTX leg units and CFX mechanized or armored units. This short-term solution is not expensive, as long as it does not preclude achieving a training objective.

In the longer run, investigate methods of improving the simulations' representation of the advantages and disadvantages of straight leg infantry for

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[8]See "Corps Picture" above for an example of a good maneuver effect between simulations and the FTX/CFX.

future exercises. This is a more expensive option if new model development is required.[9]

ENGINEERS

Issue 34: The representation of barriers, barrier construction, and barrier breaching needs work in each training mode.

Discussion: The FTX/CFX issues regarding engineers and barriers were covered in the after action report and will not be repeated here. In both ground models, questions have been raised regarding the effectiveness of different types of barriers, the time required to construct them, and the time required to breach them.

Recommendation: If improvements to the simulations are not currently planned, they should be added to the list of requested changes for each simulation. The calibration of the effects of barriers and the ability to breach them need to be reexamined as well. Players need to be made aware of these limitations before the start of the exercise. The cost of implementing these changes is not high, since the code already exists. What is required is to determine the values of the parameters, which may be a difficult task.

COMBAT SERVICE SUPPORT

Issue 35: CSS constraints need to be able to restrict the activities of combat and combat support units in the exercise.

Discussion: There are many cases of virtually unrestricted activities by live FTX/CFX units regardless of realistic logistics constraints. Of particular interest are ammunition flow to artillery units, construction consumables for engineer units, and fuels and ammo restrictions for CFX units as opposed to FTX units. In the simulations, similar concerns may be raised. Threat artillery at WPC needs to allow for restricted firing rates, if not in explicit ammunition consumption. Also during the exercise simulation, a Blue COSCOM unit was being tapped directly for replacement

[9]Since this document was written, the COBRA addendum has been added to the CBS model. COBRA accounts for some of the basic advantages of infantry in different types of combat situations, and may no longer be biased against infantry. The GRWSIM model does not have such an addendum.

assets (Class VII, major end items, including tanks and artillery tubes), so that the Blue FLOT units were being frequently replenished by players at an unrealistic rate.

Recommendation: Investigate opportunities to restrict FTX/CFX unit activities due to simulated CSS constraints. Other FTX/CFX CSS representation options include coupon books (with associated rules to preclude transporting coupons worth 30 tons of ammunition in one's pocket). The use of coupon books is not an expensive option. However, the enforcement of any exercise constraints on the capabilities of live forces tends to be more difficult.

In addition, the CSS assets of each side in the simulations need to be monitored to ensure that unrealistic resupply and reconstitution are not taking place. Moreover, the results of successful attacks on resupply facilities, assets, and operations need to be adequately reflected. If these constraints are simply a matter of changing parameter values, the changes will be inexpensive. If these constraints require code changes, they will tend to be more expensive.

AIRBORNE/AIR ASSAULT

Issue 36: The use of Red air assault into Blue's rear area did not follow doctrine.

Discussion: Even though Red was making no headway against the Blue FLOT, Red was ordered to perform an air assault insertion into Blue's rear area. This was to improve the training of the rear area cells. However, the mission did not follow Red doctrine, since there would be no use sending the air assault force in under those circumstances. This gives the Blue rear area cell no training in the prediction of likely times and locations of Red airborne or air assault insertions. If one training objective is to train the rear area operations center in operations against a realistic threat, then this training objective was not adequately accomplished.

Recommendation: The main question is how to best support the training objectives. Some realism in threat doctrine may be violated in order to achieve the training objectives. However, there are other rear area threats besides airborne or air assault that could be presented to the Blue rear area cell. The full spectrum of these threats and the conditions under which they might be initiated need to be prepared ahead of time. This will improve the Blue rear area cell's ability to monitor and predict the likelihood of a particular size and type of threat.

For example, if Red is penetrating the main sector, the Red forces are likely to take steps to keep their avenue of advance open and their exposed flanks blocked from enemy counterattacks. This includes the possible use of airborne or air assault assets to capture passes and bridges intact along the avenue of advance, while using other forces or persistent chemical attacks and other interdiction means along the flanks. If the penetration is not succeeding according to plan, deep reconnaissance units, Spetsnaz (the Soviet version of special operations forces), and drones might be used to identify key Blue threats to target and neutralize them. There is no increased cost in implementing this option since a similar operation is being performed, but in a different location or at a different time.

SOF/LRRP/SPETSNAZ

Issue 37: The representation of Special Operations Forces, Long-range Reconnaissance Patrols, and Spetsnaz forces was very limited in the exercise.

Discussion: Although there were no plans to include these assets in the simulations at the start of the exercise, some were included for particular purposes. For example, since Blue air defense was very effective against Red aircraft, Red inserted special teams to locate Blue air defense assets. Conversely, the Blue deep battle cell might have employed these special units for surveillance if the weather or other factors had precluded the use of reconnaissance aircraft.

Recommendation: Include a prearranged number of these assets for use in the rear area cells (as a threat) and the deep battle cells (as an asset). Coordinate on the options and capabilities each side has and the conditions under which they can be employed before the start of the exercise. Ensure that the play of these assets during the course of the game follows each side's doctrine, subject to the exercise-training objectives. There is no additional cost to employing them in future exercises, since they were included in this exercise. The difference is that their use will be planned by each side from before the beginning of the exercise, rather than during the exercise.

4. CONCLUSIONS

Overall, the Caravan Guard exercise was a successful experiment. Much of the experimentation that occurred was not originally planned, leading to a significant amount of adaptation and temporary confusion. However, the exercise clearly provided useful experience, both in demonstrating the technological feasibility of combining simulations with field exercises, and in identifying issues for further investigation during the REFORGER 90 exercise. The lessons learned from Caravan Guard 89 contributed significantly to the planning of Centurion Shield 90 in support of REFORGER 90, as described in the RAND Note, *Observations of the Centurion Shield 90 Exercise*.[1]

In addition, a few general recommendations were made to the REFORGER planning group to help keep the objectives and outcomes of REFORGER 90 in perspective, and as supporting material for future analysis:

- Determine in advance the tasks that will be trained, and the tasks that are experimental in nature. (See section on C2.) Ensure that the participants know which tasks are experiments so that a backup plan can be implemented quickly in case of problems.
- Set up the expectations of the participants, including the players and the training support personnel. If the players understand ahead of time which tasks are not being trained, they are less likely to be disappointed by artificialities of the training modes. In addition, the senior commanders in charge of the training will appreciate the scope of tasks that are being trained.
- Set a "freeze" date by which the determination of those tasks that will or will not be trained during the exercise is fixed. Declare this date and its implications well ahead of time to all involved parties. This tends to encourage all parties, including senior commanders, to postpone a change until the next exercise. This recommendation is included since several of the experimental features of the exercise were decided just before the exercise began or during the exercise. For example, the decision to run

[1]Patrick Allen et al., *Observations of the Centurion Shield 90 Exercise*, RAND, N-3152-A, 1992.

the simulations throughout the transition weekend occurred near the start of the exercise. A freeze date will tend to eliminate many of the risky endeavors that occur at the last minute without proper preparation.

- Carefully review resource requirements to ensure that adequate resources are available to accomplish the objectives, and reduce the scope of the exercise if resources will not be available or cannot be determined. These resources include personnel, hardware, software, time, and money. For example, sufficient training support personnel must be available to provide the training to the players. The exercise needs to provide a sufficient number of umpires in the field, specific personnel from joint (e.g., USAF) and allied services, liaison officers and scout platoons for the flanks, response cell personnel for Blue, and threat-trained personnel for Red. Planners should strive to provide robust and redundant communications links between different training modes, as well as sufficient software to support the training objectives. In addition, the software and the personnel who will interact with it need a head start of a day or two to ensure that the system is functioning properly before the start of the FTX/CFX.

There are still unresolved trade-off issues between the benefits and costs of training using simulations in support of large-scale field exercises. Preliminary results imply that the quality of training is improved in some functional areas through the use of simulations, but this is very qualitative and difficult to measure. However, it does appear that certain staff functions are being trained in this type of exercise that were not usually exercised in traditional exercise designs.

The overall costs of any type of exercise are difficult to determine, but it is more difficult to determine these costs in a mixed training mode exercise. Operational and maneuver damage costs are reduced, but simulation support costs are increased, especially in the advanced communications required to distribute the simulations to remote sites. Although cost data are much more quantitative, they are also less available due to their sensitivity and the number of different sources that are involved in funding a large field exercise.

A single exercise does not provide adequate data to resolve all the issues regarding the costs and benefits of simulations in support of large-scale exercises. However, sufficient data do exist to support some preliminary conclusions. First,

although the benefits are difficult to quantify, it does appear that the training of some functional areas does benefit from the use of simulations. For example, staff sections such as the deep battle cells did receive better training from the simulation-supported exercise than they received from a more traditional FTX.

Second, a definitive cost comparison is not possible. Clearly, operational costs for consumables such as fuel and spare parts decline when fewer vehicles are taken to the field. Maneuver damage costs also fall. But simulations bring their own costs in the form of increased communications expenses and requirements for additional support personnel. However, the absolute dollar cost may not be the most significant measure. The political benefit of reduced maneuver damage may well be the deciding factor. In that sense, simulation-supported exercises offer a real benefit. That benefit alone may make this type of exercise the preferred alternative of the future.

Appendix A
DATA COLLECTION PLAN FORMAT

Prior to the Caravan Guard exercise, we found it useful to prepare a data collection plan to coordinate observation activities. This appendix presents the data collection plan employed during the Caravan Guard exercise, along with selected improvements to the plan added during the observations. This data collection plan is included to document the categories of data examined and the procedures involved in collecting the data. Since the appendix presents the data collection plan that was prepared before and used in this exercise, it is written in the future tense.

A similar data collection plan would be useful for evaluating REFORGER 90 and other future exercises. Employing such a checklist could also assist in the exercise design process to help ensure that no functional area and its interface requirements are overlooked. Appendix B presents specific data collection requests from the different training modes to facilitate a detailed quantitative analysis in selected areas.

There are two general areas of concern regarding the exercise. The first is whether or not each training mode provided the basic level of training support, as defined by simulation and communications link uptime. The second and larger area involves how well the simulations supported training to the primary training audience, as evaluated by each functional area.

HARDWARE AND COMMUNICATION LINKS ISSUES

How often did the simulations and interfaces function during the exercise? A good basic measure of effectiveness is the fraction of the time the systems were up and functioning.[1]

Track WPC uptime, CBS uptime, WPC/CBS Satellite link uptime, and CFX/FTX unit location and status updates to CBS.

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[1]Please see Glossary of Acronyms for any abbreviations in this appendix.

FUNCTIONAL AREA REPRESENTATION AND INTERFACES

How well did the simulations and interfaces function? Were there other (noninterface) difficulties in information transfer to the training audience? What do the exercise designers need to do better next time?

The interfaces between training modes will be measured with respect to the following functional areas:

- Time resolution
- Terrain resolution
- Unit resolution (and passing info back and forth)
- C2
- Air
- Air defense
- JSEAD
- Electronic warfare (EW)
- Threat play
- Intelligence
- Corps picture
- Deception
- Deep battle
- Fire support (non-air)
- Attrition rates
- Maneuver
- Combined arms
- Engineers
- CSS
- SOF/LRRP/Spetsnaz
- Airborne/Air assault

General data items to collect on each:

- Time label for each data item listed above
- Interface problems
- Realism, as measured by subjective inputs from observers and players.

Collection Plan: All data items mentioned above and on separate data requirements sheet should be time stamped (i.e., have a time label associated with each data item).

Collection Frequency: When convenient, but it's best to sample the same person several times in the course of the exercise. How does their perception of realism evolve?

Data Format: Handwritten notes are fine, including time of interview, who interviewed, position in the exercise (e.g., player, controller), and comments.

Points of contact (POCs): To be determined (TBD).

Time resolution

WPC time resolution: Combat events assessed every 20 minutes.

CBS time resolution: Event-sequenced model. Combat events are assessed at least every hour (current setting) or more frequently depending upon the situation. Logistics assessment is less frequent (daily) according to current setting.

WPC/CBS Interface updates: exchanged every 30 minutes.

FTX/CFX unit location updates to CBS and WPC: every 4 hours.

The time resolution between the two models requires further investigation. Since CBS is event-sequenced, there is no fixed time step in CBS that can be used as a basis of comparison to the WPC models. This question will be addressed in more detail in the ongoing WPC comparison between the CBS and WPC model attrition algorithms.

Terrain resolution

The WPC uses 3.2 km hexes, while CBS uses 3.0 km hexes. Although passed by UTM coordinates, UTM coordinates received at the WPC model are translated into the center of the hexagon. Similarly, coordinates sent from the WPC model are the center of hexagon. In CBS, UTM coordinates are translated into an offset from the center of hex. Do these differences create any problems?

Unit resolution (and passing basic unit info back and forth)

Examine the frequency and accuracy of unit information transfer, and record problems encountered. (Note that the unit information being transferred between the two simulations is not necessarily related to the time steps used within each model for purposes of assessment.)

CFX/FTX updates to CBS:

The original plan was to have CFX/FTX updates sent to the WPC.

CBS updates to WPC: Determine frequency and method of transmittal.

WPC updates to CBS: Determine frequency and method of transmittal.

C2

GRWSIM: What is the simulated chain of command on each side?

CBS: What is the simulated chain of command on each side?

FTX/CFX: What is the simulated chain of command on each side?

Interfaces: None planned.

Collection Plan: Attempt to record the picture presented to the commander at division and corps level at predetermined times (to be determined). The "seamless" picture is the MOE for multiple training modes (i.e., the training audience should not be able to tell where the live play ends and the simulated play begins).

Collection Frequency: At least every six hours (see intelligence functional area below).

Data Format: See intelligence functional area below.

Air

Fixed Wing--flying against real vs. imaginary targets.

Rotary wing--flying in exercise vs. in simulations.

WPC: Emphasis in CG on deep air (AI, OCA, deep BAI), some CAS and shallow BAI played on flanks.

CBS: Emphasis in CG on CAS, helicopter, and shallow BAI.

FTX/CFX: Emphasis in CG/CF on air ground coordination procedures, especially helicopter, CAS, Recce, and BAI.

GRWSIM-to-CBS: No GRWSIM aircraft will appear in the CBS model.

GRWSIM-to-FTX: No damage to real ground forces by simulated aircraft played.

CBS-to-GRWSIM: No CBS aircraft will appear in the GRWSIM model.

CBS-to-FTX: No CBS aircraft will appear in FTX.

FTX-to-GRWSIM: Actual aircraft will not affect GRWSIM model.

FTX-to-CBS: Actual aircraft will not affect CBS.

Collection Plan: Number of aircraft (fixed and rotary wing) flown in each training mode; and any effects of air missions that cross any of the interfaces.

Collection Frequency: Number of aircraft flown (and where flown) in each training mode should be recorded for later comparison. See Specific Data Collection Requests sheet. Air effects on ground units across interfaces collected "by exception." Whenever any type of aircraft (actual or simulated) has an effect on a different training mode (across an interface), record event.

Data Format: Air effects on ground units: Hardcopy. Handwritten notes OK. Time, location, from training mode, to training mode, effect.

POCs: WPC: TBD.
DAADEN: TBD.

Air Defense

GRWSIM: AD representation not planned for this exercise.

CBS: AD representation not planned for this exercise.

FTX/CFX: Representation difficult unless actual aircraft are flown for training of SHORAD personnel.

GRWSIM-to-CBS: No GRWSIM ADA will affect the CBS model.

GRWSIM-to-FTX: No GRWSIM ADA will affect aircraft actually flown.

CBS-to-GRWSIM: No CBS ADA will affect the GRWSIM model.

CBS-to-FTX: No CBS ADA will affect the FTX.

FTX-to-GRWSIM: Actual ADA will not affect GRWSIM.

FTX-to-CBS: Actual ADA will not affect CBS.

Collection Plan: Number of AD engagements and outcomes in each training mode, and any effects that cross interfaces (none anticipated).

Collection Frequency: See Specific Data Collection Requests sheet for AD activity within a training mode. Any effects across interfaces collected by exception.

Data Format: Interactions across interfaces may be handwritten, including time, location, from training mode, to training mode, effects (if known).

POCs: WPC: TBD.
DAADEN: TBD.

JSEAD

GRWSIM: No JSEAD activity planned for this exercise.

CBS: No JSEAD activity planned for this exercise.

FTX/CFX: Representation unknown.

GRWSIM-to-CBS: No GRWSIM SEAD operations will affect the CBS model.

GRWSIM-to-FTX: No GRWSIM SEAD operations will affect the FTX/CFX.

CBS-to-GRWSIM: No CBS SEAD operations will affect the GRWSIM model.

CBS-to-FTX: No CBS SEAD operations will affect the FTX/CFX.

FTX-to-GRWSIM: No FTX JSEAD operations will affect GRWSIM model.

FTX-to-CBS: No FTX JSEAD operations will affect CBS model.

Collection Plan: None. If any SEAD operations occur in any training mode, this should be recorded (none anticipated).

Collection Frequency: On a "by exception" basis.

Data Format: Handwritten notes OK, including time, location, from training mode, to training mode, effects (if known).

POCs: WPC: TBD.
DAADEN: TBD.

Intelligence

GRWSIM: The GRWSIM Intelligence Collection Model (ICM) will be used to create the most complete picture of ground truth.

CBS: CBS will use GRWSIM ICM model.

FTX/CFX: Will fly real-world assets for collecting against live Blue assets.

GRWSIM-to-CBS: Intelligence data will be passed to CBS manually.

GRWSIM-to-FTX: Intelligence data will be passed to FTX/CFX manually.

CBS-to-GRWSIM: No intelligence data will be passed. Ground truth of unit identities and locations will be manually passed to GRWSIM model.

CBS-to-FTX: No intelligence data will be passed to FTX.

FTX-to-GRWSIM: Only ground truth (not intelligence reports) of unit identities and locations (not unit strengths) will be passed from FTX to GRWSIM via umpire reports.

FTX-to-CBS: Only ground truth (not intelligence reports) of unit identities and locations (not unit strengths) will be passed from FTX to CBS via umpire reports.

Collection Plan: The intelligence picture in each training mode at prespecified times.

Collection Frequency: Every six hours for corps deep battle cell, for "snapshot" of Blue's perception of Red and Red's perception of Blue in GRWSIM and CBS. No current plan to collect data on CFX/FTX intelligence pictures.

Data Format: Sketch maps from corps deep battle cell, standard GRWSIM output file for intelligence module, similar CBS output file for "picture" of battlefield.

POCs: WPC: TBD.
DAADEN: TBD.

EW (including SIGINT/ELINT, and countermeasures)

GRWSIM: Unknown--Manual intervention if used.

CBS: Unknown.

FTX/CFX: Unknown.

Interfaces: None Planned.

Collection Plan: Any manual interventions to make EW effects work in this exercise.

Collection Frequency: Not applicable.

Data Format: Not applicable.

POCs: None required.

Threat Play

GRWSIM: Red Front, army and division commanders facing against Northland.

CBS: Opposing Blue players (brigade level).

FTX/CFX: Blue on Blue.

Interfaces: None Planned.

Collection Plan: Look for problems in the simulated threat chain of command, the use of proper Red doctrine where applicable, and the play of Blue and Red opponents.

Collection Frequency: Every two hours.

Data Format: Handwritten notes OK.

POCs: WPC: TBD.
DAADEN: TBD.

Corps Picture

Observe the corps picture presented to Northland and Southland. Determine if it is seamless and if it draws attention to the flanks and deep battle (as opposed to just the FTX/CFX).

Collection Frequency: Every three hours.

Data Format: Sketch maps and handwritten notes are fine.

Deception

No play of deception currently planned in the simulations (not known if planned for the FTX/CFX).

Deep Battle

Observe the deep battle cell if possible. Determine if the data quantity, quality, frequency, and format are sufficient to meet the deep battle cell's needs.

Collection Frequency: Every three hours.

Data Format: Sketch maps and handwritten notes are fine.

Fire Support (non-air)

GRWSIM: Artillery parameters modified since last exercise. Specific targeting (SEAD, counterbattery, engineers) not yet installed, although damage to all units in hex still applicable.

CBS: Details unknown.

FTX/CFX: Indirect fire play inherently difficult in live exercises.

GRWSIM-to-CBS: No GRWSIM arty fires will interact with the CBS model.

GRWSIM-to-FTX: No damage to real ground forces by simulated artillery will be played.

CBS-to-GRWSIM: No CBS arty fires will interact with the GRWSIM model.

CBS-to-FTX: No CBS arty fires will affect FTX/CFX.

FTX-to-GRWSIM: No FTX arty fires will affect the GRWSIM model.

FTX-to-CBS: No FTX arty fires will affect CBS.

Collection Plan: In addition to attrition data (see below), fire support actions that cross the interfaces should be recorded.

Collection Frequency: See Specific Data Collection Requests sheet for data within each training mode. Events that cross interfaces done by exception.

Data Format: For "by exception" data, handwritten notes are OK, including time, location, from training mode, to training mode, and effects.

POCs: WPC: TBD.
DAADEN: TBD.

Attrition Rates

Focusing on differences in rates among training modes.

GRWSIM: See specific data requests sheet.

CBS: See specific data requests sheet.

FTX/CFX: To be determined after the fact from umpire reports.

GRWSIM-to-CBS: No GRWSIM attrition will affect CBS forces.

GRWSIM-to-FTX: GRWSIM loss rates might affect selected forces on the ground by fire support attacks, but not by direct fire.

CBS-to-GRWSIM: No CBS attrition will affect GRWSIM forces. If a CBS unit is destroyed or merges with another unit, this fact will have to be recorded manually.

CBS-to-FTX: No CBS attrition will affect the FTX.

FTX-to-GRWSIM: FTX losses will not be seen by the GRWSIM model until unit is destroyed or merged.

FTX-to-CBS: FTX losses will not be seen by the GRWSIM model until unit is destroyed or merged.

Collection Plan: See separate sheet on Specific Data Collection Requests.

Collection Frequency: See separate sheet on Specific Data Collection Requests. In addition, any attrition data passed across an interface (e.g., unit destroyed) recorded on a "by exception" basis.

Data Format: Events that cross interfaces may be handwritten, including time, location, from training mode, to training mode, and effects.

POCs: WPC: TBD.
DAADEN: TBD.

Maneuver

Focusing on the interfaces on flanks.

GRWSIM-to-CBS: No GRWSIM forces will appear in the CBS model.

GRWSIM-to-FTX: No GRWSIM forces will appear in the FTX.

CBS-to-GRWSIM: No CBS forces will appear in the GRWSIM model.

CBS-to-FTX: No CBS forces will appear in FTX.

FTX-to-GRWSIM: FTX FLOT will drive the GRWSIM FLOT at the interface.

FTX-to-CBS: FTX FLOT will drive the CBS FLOT at the interface.

Collection Plan: Any forces that cross the interface should be recorded (ID, time, place).

Collection Frequency: Whenever units cross from one box to another, collected on a "by exception" basis.

Data Format: Handwritten notes OK, including time, location, from training mode, to training mode, and purpose of maneuver (if known).

POCs: WPC: TBD.
DAADEN: TBD.

Special Data Item: Observe how the scout platoon interacts on the FTX/CFX flank.

Collection Plan: Umpire reports after the exercise.

Commitment of Reserves on Each Side: No reserve forces will cross the interfaces. WPC reserves go only to WPC boxes, CBS reserves (the one

brigade on each side as loss fillers) only go to CBS box, FTX/CFX reserves go in FTX/CFX box.

Combined Arms

GRWSIM: No light infantry in database this exercise.

CBS: No light infantry in database this exercise.

FTX/CFX: Determined after the exercise based upon umpire reports.

Collection Plan: Comparative attrition rates by situation will be determined after the fact from specific data items (separate sheet).

Collection Frequency: Not applicable.

Data Format: Not applicable.

POCs: None required.

Engineers

GRWSIM: Limited internal testing and "magic" barrier installation only planned for this exercise.

CBS: Barriers will be played.

FTX/CFX: Engineer tape used to simulate barriers.

Interfaces: None planned.

Collection Plan: Any manual interfaces to match engineer actions among training modes.

Collection Frequency: On a "by exception" basis whenever an interface is crossed.

Data Format: Handwritten notes OK, including time, location, from training mode, to training mode, and effects (if known).

POCs: WPC: TBD.
DAADEN: TBD.

CSS

GRWSIM: None planned for this exercise.

CBS: Selected features represented.

FTX/CFX: Details unknown.

Interfaces: None planned.

Collection Plan: Any "returns to service" from maintenance or "filler" units need to be tracked in GRWSIM, CBS, and FTX. See Specific Data Collection Request sheet.

Collection Frequency: See Specific Data Collection Requests sheet.

Data Format: See Specific Data Collection Requests sheet.

POCs: WPC: TBD.
DAADEN: TBD.

Airborne/Air Assault

Limited amount of airborne/air assault planned in this exercise to stress the corps staff. Observe as they are being planned and occur. Handwritten notes are fine.

SOF/LRRP/Spetsnaz

GRWSIM: None planned this exercise.

CBS: None planned this exercise.

FTX/CFX: None planned this exercise, but leg stay-behind operations possible.

Interfaces: None planned.

Collection Plan: No data to be collected in this area.

Collection Frequency: Not applicable.

Data Format: Not applicable.

POCs: None required.

Appendix B
SPECIFIC DATA REQUESTS DURING CARAVAN GUARD

PURPOSES

1) To support analysis for the REFORGER planning group regarding interface issues arising during Caravan Guard and REFORGER.
2) To support Warrior Preparation Center analysis comparing CBS and WPC attrition rates.

GRWSIM DATA COLLECTION REQUESTS

1) Loss rates of units in specific situations. Specific data items include:

- Game time
- Blue unit ID
- Red unit ID
- Blue unit type (artillery, mechanized, armor, leg infantry, helicopter)
- Red unit type (artillery, mechanized, armor, leg infantry, helicopter)
- Blue unit location
- Red unit location
- Blue unit mission (defend, delay, attack, move)
- Red unit mission (defend, delay, attack, move)
- Which unit is attacking
- Any defense preparations/defender's advantage
- Type terrain of engagement
- Any barriers (e.g., rivers, mine fields) across hex side
- Blue unit facing in engagement
- Red unit facing in engagement
- Blue unit percent attrition in engagement
- Red unit percent attrition in engagement
- Blue unit strength at end of engagement
- Red unit strength at end of engagement
- Effective Force Ratio in engagement (if known)

NOTE: We are assuming a 20-minute time increment for combat assessment.

2) Loss rates of units over time, and the replacement rates for units. (Given a specific unit, what is its strength over time, distinguishing between losses and replacements.) Specific data items include:

- Game time
- Unit identity
- Unit strength
- Unit mission
- Unit location
- Percentage of attrition
- Source of attrition (type of enemy unit)
- Unit replacement percentage or quantity
- Source of replacement

NOTE: The only difference between this data request and the preceding data request is the replacement percentage (or strength) and the source of the replacement.

3) Units on the edge hexes, or moving off or onto the CBS box or the CFX/FTX box (if any). (Which units on which hexes, and when this event occurred.) In general, any controller interventions to adapt GRWSIM to situations in the FTX or CBS need to be recorded.

4) Air missions over the CBS box or the FTX/CFX box (including aircraft loss rates and damage to ground units/sites) if at all played.

CBS DATA COLLECTION REQUESTS

1) Loss rates of units in specific situations. (Given an assessment cycle, what were the losses on each side in an engagement, the force ratio, the terrain, and the missions of the units like delay or defend.)

   Response: This will have to be accomplished by selecting specific units and collecting data from these units in six-hour time increments.

   NOTE: Units that are selected for "data tracking" should include all units likely to be in contact over the six-hour time block. If a unit not being tracked is engaged in combat with a unit that is being tracked, that fact should be recorded so that all influences on a particular engagement are noted.

2) Loss rates of units over time, and the replacement rates for units. (Given a specific unit, what is its strength over time, distinguishing between losses and replacements.)

   Response: Same as above.

   NOTE: Replacements (personnel and individual equipment) are delivered to particular units down to company level. Therefore, care must be taken to track the quantity and type of assets received by a unit over the course of the conflict.

3) Units on the edge hexes, or moving off or onto the CBS box to/from GRWSIM or the FTX/CFX. (Which units on which hexes, and when this event occurred.) In general, any controller interventions to adapt CBS to situations in the FTX or GRWSIM need to be recorded.

   Response: All units being played are represented in WPC and in CBS. (Follow-on forces in CBS represented to battalion and regiment level, not company level.) Which "box" a unit belongs to depends upon who is "controlling" that unit. If a CBS player controls a unit, then it belongs to

the CBS "box" even if it steps out of the CBS geographical boundaries. Similarly for units controlled by the FTX/CFX or by GRWSIM.

NOTE: If the personnel controlling their units are not aware of their geographical boundaries, problems with the interface among training modes are going to be rampant. The "boundaries" between different training modes should be clearly defined for those players actually keyboarding instructions into either model.

4) Air missions over the CBS box (including aircraft loss rates and damage to ground units/sites).

Response: This will be ignored in CBS this exercise, since only two brigade sectors are being played. Since a fast jet can traverse this space in 15 seconds, it is not worth trying to track.

NOTE: If there are any air strikes into the CBS geographical box by any source (actual or simulated aircraft or helicopters), this would be of more interest than simply transiting the airspace. The latter is important to ADA issues, but can be ignored in this exercise if necessary.

CFX/FTX UMPIRE DATA COLLECTION REQUESTS

None for CG. We will review their reports after the fact, with emphasis on interface issues. However, there may be data collection requests for REP 90 based upon the results of CG.